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Governmental Metallurgical Testing

The demand from certain quarters that the Federal government engage in metallurgical testing is persistent, even if not broadly representative of the wishes of those engaged in the mining industry. Secretary Fisher has recommended it, several members have introduced bills in Congress, and a lobby is, or will be, in Washington to exert pressure. Among the bills already introduced in Congress is one amending the organic law of the Bureau of Mines. Under it there would be no limit to the power of the bureau, except insofar as Congress holds tightly on the purse strings, which is something that Congress seems never inclined to do. This pending bill is distinctly vicious.

The Bureau of Mines serves a useful purpose in studying matters pertaining to the health and safety of miners and metallurgical workers, and in representing the Federal government in its mining interests. With respect to general technical practice, there is nothing useful for it to do beyond the elucidation of conditions and principles. Any hope that it might blaze a path of progress in the art is a will-o'-the-wisp. A course of adventure in that direction would produce some nice jobs for pleasant young gentlemen, but the accomplishment would be insignificant.

If the people must be saddled with the expense of their maintenance, we suppose they must put up with it just as they do with many other unnecessary expenditures. However, there is a distinct danger to our great industry from amateurish and mischievous meddling. Congress will be well advised if it follows the sound principles laid down by the Mining & Metallurgical Society of America, reported elsewhere in this issue. It should be distinctly understood that the proposed legislation for which a demand, based upon a variety of reasons, has been more or less artificially worked up, is deprecated by the engineering profession and by the leaders of the mining industry.

Sulphuric Acid—Western Smelters

The Department of Agriculture has been investigating the potash resources of the United States, and lately has stated "That enormous stores of potassium exist in the United States and that quantities of these products will soon be utilized on a commercial scale." This seems to us different from the conclusion of the U. S. Geological Survey, but perhaps the latter does not know so much about this subject as the Department of Agriculture. An explanation of the discrepancy is possibly to be found in the remarks of the farmers' department, that "The most promising sources of potash in the United States are the beds of seaweed or kelp groves along the Pacific coast," but it is alleged that there are also important potash deposits in other sections of the country, which indicate that "conditions point to Salt Lake City and Ogden as the great fertilizer manufacturing center of the future."

The report proceeds with the remarks that "Hitherto the smelting interests have objected to converting their fumes into sulphuric acid on the twofold ground that the people in their localities do not use fertilizers, and if they did use them the production of acid would be far greater than the demand. But if the smelters of Utah were to follow the suggestions here offered, they could put high-grade fertilizer on the market so cheaply that in a few years the agricultural interests of the surrounding territory would use their entire output."

The smelters of the West are notoriously wasteful and unreceptive to new ideas. They have persistently preferred to throw away the sulphur of their ore, even at the expense of smoke damage, rather than to render it both innocuous and profitable by making sulphuric acid

out of it. Is it to be expected that they will now defer to the words of wisdom from the Solomons of the Department of Agriculture, or will they continue to manifest that they are "from Missouri?"

Hand Sorting

As its readers know, the JOURNAL has long been an advocate of the more extensive use of hand sorting in the concentration of ore. We feel a natural pleasure in observing practical progress in this direction. A few years ago hand sorting was an unknown art in the Cœur d'Alene although there never was a district where better use of the principle could be made. The former practice in that district of running chunks of nearly pure galena through the crushing machinery was little short of criminal.

At present there are but few mining companies in the Cœur d'Alene that fail to practice hand sorting. As illustrative of the advantage, the remark of W. Clayton Miller, general manager of the Federal Mining & Smelting Co., in the latest report of that company, that "As a result of improvements in operation largely through sorting, the profit at the Morning mine for the year as compared with the loss of the previous year has improved in an amount equal to approximately 7% of the amount invested," is interesting. It is further interesting to report that hand sorting has lately been successfully introduced in at least one mill in the Joplin district, the application in that case being for the discarding of waste.

Mr. Carnegie and Mr. Stanley

Mr. Carnegie was not as pawky in his testimony before the committee of the Hon. Stanley and fellow wiseacres as he was before the Ways and Means Committee a few years ago; and displayed that he, like many other people, would benefit from a course of serious study of economics, especially of the conditions that establish prices. In his assertions that competition in the steel business no longer exists (compare the experiences of 1909 and 1911) and that no new steel business can now be developed (compare the operations of Mr. Schwab) and that no important new supplies of iron ore are available (Texas? Sweden? Cuba? Brazil?), we fear that his recent preoccupation in the endowment of libraries has shut his eyes to industrial progress. This is not an aspersion upon the present quality of Mr. Carnegie's eyes, because there is no reason now why he should turn them in that direction. Anyway, Mr. Carnegie furnished three days of agreeable entertainment to the Hon. Stanley and confrères, and received a check for $26 for witness fee and expenses, which he is going to frame as a memento of the occasion.

Herman Frasch

The award of the Perkin medal to Herman Frasch is an honor justly deserved. Mr. Frasch invented an absolutely new method of mining brimstone, differed from the ordinary run of inventors in his ability to put his invention into commercial application, developed in Louisiana an industry which in a few years was able to supply practically the whole American requirement of brimstone, which previously had been imported from Sicily, and won for himself and associates a large fortune. Never was there a fortune more cleanly earned. Untainted by chicanery it was obtained by the simple conversion of brains into money. Mr. Frasch is fully entitled to the honors that are conferred upon him.

The Advance in Copper

The advance in copper seems to have culminated. Even so, everybody ought to be happy. The producers who have been carrying uncomfortable stocks of metal have unloaded them. Those who have been curtailing their output have been enabled to resume at former capacity. Two new mines have been satisfactorily financed. The tired holders of some copper-mining shares have liquidated. The new owners have not paid for some of them any more than they are worth. So everybody ought to be happy, as we remarked above. It may be urged that the users of copper are not happy. Nevertheless, they ought to be. In the first place they all had an equal opportunity to buy copper cheaply only three months ago, and even on the advance they have not had to exceed what everybody admits to be a fair price. Of course, the producers ought to have an inning some of the time.

The dissolution of the important firm of Wernher, Beit & Co. is a matter of interest in Transvaal gold mining, in which the firm had a great influence owing to its large ownership in the mines. It is due to the failing health of Sir Julius Wernher, the head of the firm. The gold-mining interests of the firm have been transferred to the Central Mining Corporation and the Rand Mines, Ltd., while the firm of Breitmeyer & Co. takes the diamond business. Sir Julius Wernher was one of the earliest investors on the Rand, and he gave much time and thought to the general industrial progress of the country.

Transvaal gold production in December was slightly less than had been anticipated. It was rather less than in November for reasons which the cable does not explain. The total production for 1911 was therefore $170,273,734, or only about $200,000 less than our estimate. The increase over 1910 was $14,543,474, or 9.3 per cent.; and the total was over 36 per cent. of the total production of the world. The Transvaal was, therefore, by far the most important factor in the great production of gold in 1911; the United States, the second producer, contributing only 20 per cent. of the total.

The result for 1911 is a remarkable one, especially when we consider that 95 per cent. of it came from the narrow and limited area of the Witwatersrand.

A feature of the past year in India has been the larger demand for gold, accompanied by a decrease in that for silver; although that decrease is much smaller in proportion than the increase in gold. In the past five years it is estimated that India has absorbed, in round figures, $100,000,000 in gold; but about $39,000,000 of this amount was taken in 1911. For reasons heretofore noted, it is probable that Indian savings will be invested much more largely in silver than in gold, since gold coin or gold ornaments are beyond the means of the very great majority of the people. It seems to be evident, however, that the wealthier class is turning from its traditional preference for the white metal, and is accumulating gold to a much greater extent than formerly. This tendency may have an important effect on the silver market later.

By the Way

The 600 men employed in the large Newport mine at Ironwood, Mich., received Christmas gifts from the company, consisting of checks equal to their regular December earnings. By this plan the men receive 13 months wages per year. The custom has been maintained for several years by the owner of the mine, Ferdinand Schlesinger, of Milwaukee, Wisconsin.

The recent publicity as to Julian Hawthorne's mining schemes brought to light a reply which Hawthorne once received to one of his mining letters in which he told the recipient that he had decided to give up literature for mining, says the New York *Sun*. The man who got the letter was something of a wag and had a small printing press. So he printed a small folder with only a few leaves and one word on each leaf. This he sent to Hawthorne with a letter stating that he was much interested in the author's communication, inasmuch as he had taken an opposite course and had given up mining for literature, as the inclosed pamphlet would show. The words, one on each leaf, were as follows: "Prospect" — "Prospectus" — "Mine" — "*M i n e*" — "Minus." He never got a reply.

A new method of selecting mine inspectors is the only way to decrease the number of mine accidents, says S. D. Warriner, general manager of the Lehigh Valley Coal Co. He would put the U. S. Bureau of Mines in charge of underground workings and have inspectors appointed by that bureau and held responsible as civil-service appointees. Mr. Warriner is a member of the Pennsylvania board for examining candidates for mine inspectorships. He says that few men who apply are able to fill the place as it should be filled, and that few mine foremen are competent to be inspectors. It needs a higher grade of education, he said. The last part of Mr. Warriner's remarks is undoubtedly correct. As to the first part, he does not suggest how the U. S. Bureau of Mines could constitutionally be put in charge. Perhaps the sovereign State of Pennsylvania could make a contract with it to take charge of this department of police affairs, retaining its own rights.

The Oliver Iron Mining Co. will maintain a visiting nurse, to work among the families of its employees in Ishpeming, Mich. The nurse will be paid monthly by the company and will serve the miners and their families free of charge. The plan has given good results with the Cleveland-Cliffs Iron Co., which maintains visiting nurses in Ishpeming, Negaunee and Gwinn. It has been found that the influence of a skilled nurse in a miner's home during sickness in the family, has been in the nature of an education in sanitary conditions to the inmates.

Perhaps the most profitable business in the whole world during 1911 was that of selling Porcupine options, says the New York *Evening Post*. Only a few could engage in it, because there were only so many claims to begin with, though once the demand arose everything possible was done to enlarge the area of the gold region in order to satisfy it. The sale of an option in a majority of cases turned out to be a short sale. The original owners of the options will get them back, through the inability of the purchasers to make final payments. The claim owners, therefore, are enriched by the first payments down, and will have their property back, gold and all. Scores of Porcupine mining companies were floated on options; if enough stock could be sold to finish paying for the option, well and good; if not, the promoter had got something, the buyers of the shares had acquired experience, and no gold had been disturbed. The reputation of a mining camp fluctuates violently. That of Porcupine has had a big fall. Possibly it will rise again. Many who proclaimed that Porcupine was the greatest gold camp ever discovered in the world, without ever having been nearer to it than the Toronto hotel where practically all promotions originated, are now denying that there is any gold in Porcupine. Their information has not increased. Porcupine shares have flattened out in a speculative way. That is all.

Senator Warren has introduced a bill providing for the establishment of a mining-experiment station at Lander, Wyo., under the direction of the Bureau of Mines. It has already been proposed to establish a similar experiment station at Auburn, Calif. What is the matter with the other states and why is it that only these two important mining centers are to have experiment stations? It would seem that the senators from Texas to North Dakota and from Maine to Washington are most remiss in their duties, but amends may be made when they awake to the fact that it is proposed to appropriate $25,000 for the establishment of such stations and that a superintendent and a chemist are to be appointed at salaries of $4000 and $2500, respectively. Besides making experiments as to the treatment of all metalliferous ores, it "shall be the duty of said superintendent and chemist to receive for assay or analysis all rock, cement, clay or other mineral-bearing substance that may be deposited with them by any citizen of the United States and make proper classification or assay of each sample * * * for the purpose of ascertaining the exact amount of gold, silver, copper, iron, zinc, lead, tungsten, vanadium, uranium, wolfram (*sic*) and other rare minerals, tin, barytes, marble, manganese, coal or any other mineral known * * *." With free assays, the prospectors will doubtless call for "the whole bill of fare" from "wolfram and other rare minerals" down to marble, manganese, coal or any mineral known. We can foresee that an arbitrary or officious superintendent who limits a sovereign citizen or fails to find what the latter "knows" to be in the rock, would better prepare to meet his maker. We assume that a beneficent and paternal government will not exact a charge from its citizens for this work. If this were to be the case, how would it be an improvement on private assaying? Of course, some benefits might accrue to wildcat promoters who could thus get the stamp of the government on the assay of some particularly rich specimen rock to aid them in harvesting a new crop of "suckers" that could not be hooked without the "accompanying U. S. Government official report, which shows our King Solomon group to be the richest gold mines in the world. The price of the stock will be advanced on Feb. 1 to 75c. per share."

Capt. Bill Jones in his lifetime won a well deserved admiration. His name came up the other day before the Stanley committee. "Do you remember Bill Jones?" asked Chairman Stanley. "Do I remember Bill Jones? Of course I do," returned Mr. Carnegie. "I'll never forget him. He was the most remarkable character we ever had, not excepting even Charley Schwab. He had been a private in the war. I sent for him, told him, 'I want to make you a millionaire, to become a partner.' He replied he wanted nothing to do with business, wanted to work for a salary. 'All right,' said I, '$50,000 a year, the salary of the President, is yours.' He got more than that. The president of the Cambria Iron Works came and declared, 'You'll ruin the steel business. What do you mean by giving Jones double the salary I and Felton give?' I asked them to tell me where they could get another Bill Jones for double the salary." Chairman Stanley wanted to know if Capt. Bill was a kind-hearted person, considerate of the men who worked under him. "He was a little abrupt," replied Mr. Carnegie, "but he was able. He was not as suave as Schwab. The trouble was he had no education. Jones was the best manager of men of the old type." Mr. Stanley brought out that Capt. Bill Jones was opposed to men working more than eight hours a day, believing that, in fairness to labor and with a view to gaining greater efficiency, the men should not be worked on shifts longer than eight hours. "We tried eight hours with the men on the blast furnaces, but the men objected because they lost wages by it," said Mr. Carnegie.

Mining and Metallurgical Society

The Mining and Metallurgical Society of America has recently taken action upon several questions of public importance. It has addressed the following memorial to the President of the United States:

The Mining and Metallurgical Society of America respectfully calls your attention to the importance of carefully considering the mining industry in its relations with the Federal courts. It is a fact known to all persons connected with this industry that the provisions of the mining law at the time of its passage were few and apparently simple, but with the advance in the knowledge of ore deposits it was found that these apparently simple provisions failed to cover many occurrences, and it has devolved repeatedly upon the court of last resort to interpret the fundamental law, with the result that the legal provisions governing mining titles and rights are today in major portion those that have been established by judicial decisions.

Few matters of greater importance, either in their financial aspect or in their bearing upon the welfare of large communities, come before the courts of the United States.

It is the request and hope of the Mining and Metallurgical Society of America that jurists of distinction and noted ability and experience in this and associated industries will receive the favorable consideration of yourself in connection with the filling of the vacancy which now exists.

Bureau of Mines

The society was requested by the chairman of the Committee on Mines and Mining of the House of Representatives to advise that committee respecting a draft of a bill for a new organic law for the Bureau of Mines. The society prepared such a draft that was based upon the following principles:

1. That the scope of the Bureau of Mines should be enlarged so that its functions will certainly cover the preservation of health in mining as well as safety.
2. That the functions of the Bureau of Mines should be limited to the elucidation of fundamental principles and the study of questions broadly affecting the mining industry.
3. That governmental encroachment upon private enterprises should be prevented by the organic law.
4. That the engagement in private work by employees of the Bureau of Mines should be prohibited by the organic law.

The bill drafted by the society upon the above principles provided that:

Sec. 2. It shall be the province and duty of the Bureau of Mines, under the direction of the Secretary of the Interior, to conduct inquiries and scientific and technologic investigations concerning the mining, extraction, preparation, treatment and utilization of the mineral substances (including petroleum and allied substances) of the United States and its possessions, with a view to increasing the safety and preserving the health of persons engaged in mines, quarries and metallurgical works, and with a view to the elucidation of the conditions existing in the mining, quarrying and metallurgical industries; and concerning the explosives, fuels and other mineral and metal products belonging to or for the use of the government of the United States, with a view to their most efficient use; and to disseminate the information resulting from these inquiries and investigations, or from other sources, together with appropriate recommendations, in such manner as will best carry out the purposes of this Act.

The society also added the following new sections:

Sec. 4. Nothing in this Act shall be construed as in any way granting to any officer or employee of the Bureau of Mines any right or authority in connection with the inspection or supervision of mines or metallurgical plants in any State; nor as granting to the Bureau of Mines any right or authority to undertake any investigation or operation in behalf of any individual person, partnership, corporation or association except for the health and safety of persons employed in the mining, quarrying and metallurgical industries.

Sec. 5. No person who is regularly employed by the Bureau of Mines shall be permitted to undertake special engagements, or accept employment for compensation, from any person, association of persons, or corporation; nor shall the Bureau of Mines detail any such regular employee to perform such service except as above stated. Provided, that this prohibition shall not be construed to apply to such engineers or experts as may be connected with the said bureau in a consulting capacity, or in the investigation of any special matter, and whose principal professional practice is outside of such employment by the bureau.

Alaska Coal Lands

With respect to the question of the Alaska coal lands, the society adopted the following resolutions:

1. It is essential for the proper development of Alaska that its coal fields be opened for commercial use without further delay.
2. There are now known to exist but two relatively small fields containing high-grade naval fuel, and inasmuch as the government now possesses no original source of such supply on the Pacific coast, it is desirable in the interests of national defense that a selected area of these fields be held and operated under the direct control of the government.
3. All rights which have accrued legally under statutes heretofore existing should be recognized.
4. If it be decided by the Congress that it is to the best interests of public welfare that coal lands in Alaska be leased, we recommend that the following conditions should be embodied in the leases:

a. These leases should be made for all the coal in the ground.

b. The royalty should be low and based on percentage of selling price of the coal at the mines.

c. The minimum annual production upon which royalty is to be paid should be nominal for the first two or three years after the execution of the lease in order to permit and encourage the installation of efficient and durable equipment. After that period the minimum production upon which royalty should be paid should increase more rapidly than the area increases. For example: the minimum production upon which royalty should be paid on a tract of 5000 acres should be several times more per acre than for 1000 acres. Such a plan would prevent the tying up of large areas of undeveloped coal territory.

d. A due-diligence and forfeiture clause to effect continuous work should be included in the lease.

e. Leasehold in coal lands should include all necessary timber, mining and surface rights.

f. Leases should not be given for less than 40 acres, and in shape should be rectangular, their boundaries being east and west and north and south, and after the system of public surveys has been extended to Alaska and the land applied for is in a surveyed township, the unit areas of a lease should be those established by the government survey as subdivisions of the sections.

g. The length of a tract of land embraced within a single lease should not be more than three times as great as its width.

5. It should be clearly recognized as a basic principle that the value to the nation of coal lands in Alaska lies more in their use for industrial, commercial and naval purposes than in the royalties to be derived therefrom, and it is desirable that the revenue obtained from coal royalties inure to the benefit of the territory.

All of the actions were taken formally by the society after approval of its council and letter-ballot of its entire membership. In each case the opinion of the society was expressed by an almost unanimous vote.

Mount Lyell Report

The annual meeting of the Mount Lyell Mining & Ry. Co. was held in Melbourne, Nov. 24, 1911. The quantities of ore raised during the half year ended Sept. 30, 1911, were unsatisfactory, and costs high, owing to labor shortage and a strike begun in the period under review, but assays remain good, and the richest ore in the North Mount Lyell mine is being found in the 1100-ft. level. The ore reserves were increased to 1,023,362 tons by the six months' work.

In the half year 3797 tons of copper, 246,099 oz. of silver, and 5018 oz. of gold were produced. Costs per ton of blister produced were: Mining operations, including stripping charge on open-cut ore, $2.22; smelting, $2.32; converting, $0.33; total, $4.87. These figures in the half year ended Mar. 31, 1911, were: Mining, $1.91; smelting, $2.10; converting, $0.28; total, $4.29.

The company operates three phosphate works, Yarraville (Victoria), Port Adelaide (South Australia), and Freemantle (Western Australia). The profit from all sources for the half year amounted to £69,033, but in view of the strike the dividend was passed, for the first time since 1897.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

The Dwight-Lloyd Sintering Process

In the JOURNAL of Jan. 6, 1912, I note an article on the "Metallurgy of Iron and Steel," by Bradley Stoughton. In his reference to sintering ore, he states it is done by the "Gayley-Dwight-Lloyd process."

I beg to advise that I am in no sense associated with this process, and am simply identified with the company which has rights from the Dwight & Lloyd Metallurgical Co., for operating in the field of iron-bearing materials. I feel it is only just to the inventors to eliminate my name in connection with this process.

JAMES GAYLEY.

New York, Jan. 11, 1912.

Cyaniding Cripple Creek Ores

In the JOURNAL of Dec. 23, 1911, there appears a statement made by R. W. Hadden, of Los Angeles, Calif., to the effect that Philip Argall is not entitled to the credit of first applying the cyanide process to the treatment of Cripple Creek ores; several other statements were offered for the purpose of proving this assertion.

In justice to one who did more for the Cripple Creek district than anyone else, I wish to make the following statements. I lived in Florence at the time and was a member of the firm which did the excavating for the Dorcas mill which is spoken of in the article in question. As near as I can remember the "Cyanide Mill" built at Cyanide, Colo., a suburb of Florence, under the supervision of Philip Argall was completed in 1895, some five years before the author conceived his scheme.

The Dorcas mill was not built at Cañon City, but at Florence, and if I remember rightly the builder's name was Hower. This last I am not absolutely sure about, however there is only one chance in a thousand that I am mistaken. If so it is in the spelling only.

R. G. MCDONALD.

Mono Lake, Calif., Jan. 8, 1912.

[Everybody knows that Mr. Argall was a pioneer in the cyaniding of Cripple Creek ore, his work dating back to about 1894. He built and operated successfully for several years the large works of the Metallic Extraction Co., at Florence. In the contest between the chlorination and cyanide mills of this district, the former were temporarily victors, but improvements in the cyanide process, rendering it able to treat a lower grade of ore, have now put the shoe on the other foot. We understood Mr. Hadden to refer only to the treatment of low-grade ore. There may be a question as to the definition of "low-grade ore."—EDITOR.]

The Use of Long and Short Handle Shovels

One would think that the practice in such a simple operation as shoveling would be uniform in metal mines, at least in the same country, but that is not the case. The iron and the copper mines of Michigan use for mucking the ore a short, D-handle shovel having a handle length of 26 in., approximately, and a total over-all length of 38 in., while in the mines of the West, with the exception of Cripple Creek, a long-handle shovel is used that the shoveler saws off to suit himself. Being from the West and accustomed to its methods, the use of the D-handle shovel looks odd to me. Indeed, it does not look to me as though in a mine a man could possibly shovel as easily with such a shovel as he can with one having a long handle. The short-handle shovel makes a man do practically all the work of shoveling with his back muscles instead of distributing the work among several sets of muscles. For instance, at every shovelful there is a slight hesitancy as the man puts the knee of his back leg against the elbow of the hand with which he has gripped the D of the shovel. When he has done that, he pushes the shovel into the pile of ore; then, without any aid of the leg muscles, he rises, turns around and throws the ore.

To push to advantage it is necessary to apply the pushing effort from a point of the body ahead of its center of gravity; so it should be the front leg that gives the push forward that sends the shovel under the pile for its load. Moreover, the force should not be applied between the knee and the elbow, two parts of the body that are easily injured; instead, the place of incidence should be some pad of muscles. Moreover, it is not so efficient a way of shoveling to load the shovel with a push from the leg transmitted through some other part of the body, as it is to drive the shovel ahead under the ore with the leg pressing directly against the shovel. In the flat dipping lodes of the Lake Superior copper district with the low car and the ore right up against the track so that in handling much of the ore the shoveler is cramped for room, the disadvantages of the short-handle shovel do not become so evident as they would otherwise, for room is essential to easy use of any shovel, but were it necessary for the man to give much of a toss to the ore to get it into the car the fallacy of putting almost all the work upon the back and arm muscles and leaving out the aid of the leg muscles, the most powerful ones in the body, would be immediately evident, I believe.

In shoveling with a long-handle shovel a man needs more lunging room than he does with a short-handled shovel of the type under discussion, but provided he has the lunging room a man can work in just as narrow if not a narrower space than can a man with the other kind of shovel. For instance, it is no uncommon sight in the West to see two men shoveling into a car in a drift as small as six by seven feet. In taking the load, the man with the long-handle shovel has the handle of it against the large muscle of his forward leg, which is slightly bent. With a push of his leg forward, at the same time giving a little spuatting motion to his whole body, as if getting ready to spring, he drives the shovel forward under the ore, and even if it meets considerable obstruction, there is no hitching to get the load on the shovel, as is quite often the case with the shoveler using the short D-handle implement.

The shovel being loaded, the man gives a slight spring upward by straightening his legs, and tears the shovel and its load clear of the pile. Then, with the momentum up, the rest of the shoveling cycle is completed with the back and arm muscles. In this way full advantage is taken of the leg muscles in shoveling. Indeed, in Western mines one can tell a shoveler by looking at the legs of his overalls and even know whether he is a left- or right-handed shoveler; but at the Lake Superior copper mines there is no way of telling a shoveler except by guessing from his nationality and looking to see whether there is any mud from water-holes on his clothes. Indeed, the weakness of the short-handle shoveling system, which as I have pointed out is in getting the load, is tacitly admitted by those mine captains that claim a short-handle, square-point shovel to be best for plat work and a long-handle, round-point for shoveling on a rough bottom. Why not the D-handle

shovel for both kinds of work? And why, if the short-handle shovel is better for shoveling on a rough bottom is it not better for shoveling on the smooth sollar?

It is said that the two kinds of shovels have been tested in the iron country, and that the short-handle shovel was found to be the better. I cannot say anything in regard to that, as I have never been there and have never seen how that ore breaks, but I understand that much of it is soft, and consequently it would not be so apt to break into slabby pieces that interlock in a pile as copper ores tend to do, and surely there cannot be as many boulders in the pile as in the ore that comes from the stopes of the copper country. Moreover, a Western shoveler would not attempt to shovel without using his pick occasionally to get boulders that are buried in the pile before they interfere with his shoveling, but in the copper country the shoveler's main implements, besides the shovel, are the sledge and gad. I have never in my trips through the Lake Superior copper mines seen a trammer, as the shovelers are called, working with a pick to loosen the ore before starting to shovel it. All that I can say is that any test with the labor accustomed to present shoveling methods in the iron or copper country of Michigan would not be fair to the long-handle shovel, no more than it would be for the short-handle shovel to be tested in Butte with labor accustomed to the long-handle shovel, for there the tests have shown that the long-handle shovel is the better.

It seems to me that it would be an excellent idea if some company, instead of giving a large prize for a double-hand drilling contest, would offer as large a prize for a shoveling contest to test out, in an eight-hour shift, under actual conditions of ore as it lies broken in a mine both with and without boulders in the pile, all the ore being broken down to ordinary shoveling size, the merits between the two kinds of shovels.

There ought to be a right way and a wrong way of shoveling. It does not seem as though there should be two ways of shoveling as there are at present in the mines of this country. I predict, if any such contest is ever held (and it would be of far greater benefit to mining than a drilling contest, in spite of the spectacular effect of the latter, one of the most thrilling and beautiful musclar exhibitions that I know of) that just as the stationary seat and unaided back swing were upset in rowing by the sliding seat and the back swing with the leg drive, so will the long-handle show its supremacy over the short-handle shovel.

The only reason that I can see that short-handle shovels should be better in the mines of the copper country having a flat dip is that the shovelers have to tram their own ore to the stations. The use of the long-handle shovel, which as I have said throws a considerable part of the work on the leg muscles, might throw too much work on the legs when this tramming labor is considered.

The stoping in the Lake mines is characterized by the great size of the ore that is broken in the stopes. As a result fully 60% of the rock is coarser than four inches and probably considerably over one-third the ore is loaded into the cars by hand. Therefore it is not quite fair to use the tonnages handled in these mines, even when comparing them with figures for shoveling in drifts in Western mines in which the shovelers have had to do their own tramming, for it is generally easier to load a ton of boulders than to load a ton of fine dirt. It would be interesting to compare the two systems of shoveling with the ore broken small enough to be handled in wood-lined chutes.

The proper way to shovel is a fundamental question in mining in regard to which there is no general agreement. Undoubtedly under certain circumstances one type of shovel is much better than another. I do not believe that there is any question but that where ore has to be tossed any distance the long-handle shovel is the better of the two. But then there arises the other question, how the long-handle shovel would compare in efficiency with a short-handle shovel and a wheelbarrow for getting the ore into the chute. There is also the large question of how far it pays to throw rock with a shovel instead of loading it into a wheelbarrow. A discussion of this subject ought to appeal to engineers, and it would have much practical value. The Western miner would learn something to his advantage about shoveling, and so would the Eastern miner. In giving tonnage statements, the working conditions, the size of the ore handled, the temperature of the workings and the condition of the ventilation are of importance for making comparisons.

CLAUDE T. RICE.

Hancock, Mich., Jan. 6, 1912.

Underground Waters and Mining

An interesting suggestion was unwittingly made in an article that was recently published, but I can recall neither the title of the article nor the paper in which it was published. In one part of this article it was stated that certain companies were sinking churn-drill holes to tap a supply of underground water for use in the mills and in another part of the article, that operations at a small mine in the same vicinity had to be abandoned on account of the great influx of water that the fairly large pumps were incapable of handling and the rate of flow of which seemed not to diminish as the mine filled with water.

It was particularly notable in this instance that complete surveys of the underground waters of the region had been made by the Geological Survey. The data had been published and the large companies that were sinking the drill holes knew that a large body of underground water could be reached at a certain depth. The mines of these companies were so situated that the deep levels had not reached the level of this water. The small mine was situated in lower country and had the owners stopped to consider that, at a comparatively shallow depth, the lower workings of the mine would be below this level, they might have foreseen the result and saved the loss of what, to them, was a considerable sum of money spent in development work.

In this case it was indeed strange that working the mine should have been attempted for the existence of the underground water was generally known in that vicinity and it would have been an easy matter to ascertain its approximate level and what would be the natural consequence of making mine openings below that level. It seems that the owners were advised to the effect that there was every possibility of their work being stopped by a great influx of water, but as the advice was given *gratis* it was probably not valued.

This experience emphasizes the prevalent negligence of many who undertake mining to take full advantage of the physical conditions of the country as have carefully been determined and made known by competent engineers. There is a large number of underground water papers that have been published by the Survey, the perusal of which might benefit those who would mine in such districts.

OBSERVER.

Phoenix, Ariz., Jan. 8, 1912.

Traveling in Colombia

The excellent article by R. D. O. Johnson in the JOURNAL of Dec. 30, 1911, gives many pointers on traveling in the tropics, which all those who intend to make their initial trip to such countries would do well to observe carefully.

There is one suggestion that might be elaborated to a slight extent—that pertaining to mosquito bars. Mr. Johnson recommends a bar six feet high, but from my own experiences would unhesitatingly advise using one eight or nine feet high. Most houses in the tropics are built with high ceilings, so that a high mosquito bar can almost always be used. The cloth that will effectually exclude the mosquito is of so fine a mesh that ventilation is seriously interfered with, and unless the bar be high, the heat and bad air under the bar will make sleep impossible in low districts.

J. A. HERDY.

New York, Jan. 12, 1912.

Details of Practical Mining

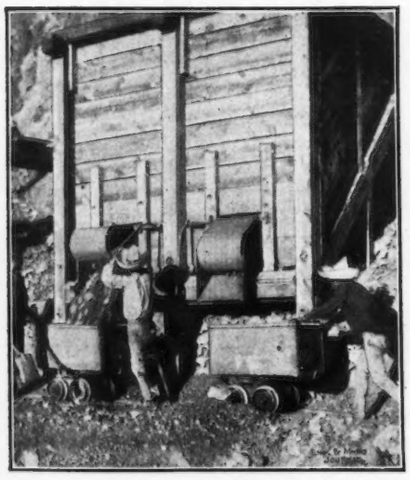
Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

Gate for Ore Bin Chutes

BY FRANKLIN W. SMITH*

The gate for an ore-bin chute, shown in the accompanying illustration, is in use at some of the mines near Parral,



STEEL DROP GATE FOR ORE BIN

Mex. It consists of a sheet of steel of sufficient thickness to be rigid enough to resist bending under ordinary use. The lower end is bent in a semicircle, as shown; the upper end is riveted or bolted to a square bar of iron turned round at the points where it is supported by the bearings. The gate is raised and lowered by a lever attached to the square bar.

The bottom of this ore bin slopes toward the front at an angle of 45 deg. For dry ore a slope of 35 deg. would be better. The bent end of the sheet of steel should not be so large as to hold a heavy weight of ore, as in that case there might be some difficulty in lifting it. In closing the gate a quick downward stroke of the lever will check the ore.

*Mining engineer, care Alvarado Mining & Milling Co., Parral, Chih., Mex.

Hauling Heavy Machinery

The moving of heavy or unwieldy pieces of machinery short distances is often a problem that the engineer engaged in construction work is called upon to solve. There is a knack to the art which is only gained by experience, a knack that is the rigger's stock in trade, but there is much hauling to be done about mines that hardly warrants the engagement of a rigger.

The following kinks are for use in hauling over a short stretch of fairly level road. In moving a section of a standpipe or smokestack or other bulky object that is awkward to handle, or which is too long to be put in the body of a wagon, the ends of two poles of equal length, a few feet longer than the object to be moved, are fastened to the back of the body of the wagon at a convenient distance apart, the other ends of the poles resting on the ground so that the inclination is about 30° to the horizontal. The spacing of the poles is rigidly maintained by inserting distance pieces, the ends of which are gained into the long poles and which are held in place by tie-rods passing through the long poles on each side of each distance piece. The distance pieces are placed one at each end and as many more between as may appear to be necessary. The section of pipe is hauled up the inclined poles so that it occupies a position parallel to the poles and is made fast by suitable cleats spiked to the poles. It is then hauled to the desired place, one end of the skid poles resting on the body of the cart, the other ends on the ground.

For hauling over wet, slippery, but level roads, a convenient skid or sled may be made by cutting a small tree just below the fork of two fairly long and straight branches. The forked end is trimmed with an ax, so as to curve upward somewhat like the bow of a canoe, so that it will slip forward easily when dragged over the road. The small branches are trimmed off and the side of the two large branches, which are to form the running surface of the sled, are trimmed off flat and smooth with an adze. A distance piece is gained into the extreme ends of the two branches, and tie-rods are used on each side, the distance piece being a little shorter than the distance between the ends of the branches or runners of the sled, so that the branches will have to be drawn in several inches by the tie-rods to hold the distance piece in its gains. Cross-pieces are then spiked across the runners or branches at intervals of three or four feet. An eye-bolt or clevis is then fitted into the curved, front or forked end of the sled, into which the hook of a block and tackle is placed.

This sled can be drawn directly by horses when light loads are moved; for heavy loads it is better to use a block and tackle and a snatch-block, attached to trees along the roadside. In such a sled a boiler weighing 11,000 lb. was moved over a muddy road, three-quarters of a mile long, in eight hours, with tackle, snatch-block and four yoke of oxen.

Roller Frame for Incline Shafts

In most of the shafts of the Michigan copper country the rope roller is carried on frames in which the position of the roller with respect to the rope is fixed, and

ROLLER FRAME FOR INCLINED SHAFT

where wide rollers are used, the custom is to change them to different frames in order to have them worn in three grooves before being thrown away. This necessitates the removal of the caps of the bearings each time. In the Mohawk mine a style of roller frame is used in which only four bolts must be loosened to permit the roller to be moved so that the wear will come in a new place. This allows the rollerman to change the position of the rollers more quickly and so keeps him in less danger, for all roller changes are made while the skip is running. In order to aid the rollerman in his work, a pit is cut at each roller so as to give him a small flat place where he can work with the roller coming about waist high.

In the Mohawk shafts concrete stringers are used to carry the skip rails. The roller frames are bolted to carrier sockets, made by cutting a ⅜-in. sheet-iron plate so that the cut parts can be turned up to form the socket into which the carrying pieces of the roller frame can slide, and to which they are securely held by a bolt going down from a top plate through the bottom plate of the flanged socket. These sockets are held to the concrete stringers by bolts seated in the concrete when the stringer was made. The frame consists of two carrier pieces made of two 2x4-in. pieces placed on edge and bolted together with distance pieces between so that the bolts that are used to fasten down the cross pieces carrying the bearings can slide sideways between the two pieces when the bolts are loosened.

Temperature Measuring Pendants

The temperatures of gases in flues and chimneys are determined by the Green Fuel Economizer Co. by the use of the tensile strength of metal pendants instead of the melting point as the true indication of temperature. The pendants are made with a large body, having a certain definite weight, suspended from a narrow neck. The composition of the metal may be varied and the cross-section of this neck is adjusted until the body of the pendant will pull the neck in two and fall at some desired temperature.

In actual use, the pendants are hung upon a wire hook, which is introduced into the flue with the pendant at the desired point, beginning with the lowest temperature pendant, and proceeding until the one is found which will not fall off after five or ten minutes' exposure. The flue-gas temperature will then be somewhere between the temperature marked on the last pendant and the next to the last pendant used.

Pendants for three temperatures have been perfected, namely, 425°, 500° and 550° F., representing respectively the temperature at which the use of the economizer is justified with coal at commercial prices, the temperature at which an economizer is a good investment in all cases, and the temperature at which neglect to install an economizer becomes waste.

Sheaves for Balanced Hoisting

By P. B. McDonald*

At the Mary Charlotte shaft No. 2, at Negaunee, the arrangement of the two sheaves for balanced hoisting is being changed. The two skip-compartments and the hoist lie in the same line. To make room for the hoisting cables, the sheaves were put in leaning outward at a small angle; one leaned to the north, the other to the south. This made it possible for the cable going to the west sheave to escape touching the eastern sheave. However, this arrangement has not been satisfactory, and one sheave is to be elevated several feet above the other and both will be straightened to a vertical plane.

*Mining engineer, Negaunee, Mich.

A Solution Clarifier

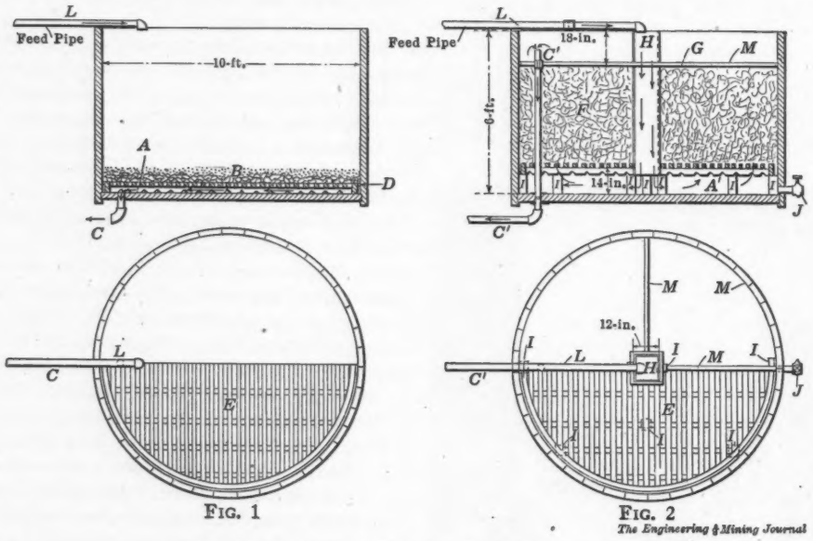
By C. R. Olson*

In Fig. 1 is shown the type of clarifier which was installed during the erection of the Tonopah-Liberty mill in 1910. The medium of clarification or filtration was cocoa matting covered by canvas on which were placed successive layers of sand, grading gradually from gravel next to the canvas to coarser than 20-mesh sand in the uppermost layer *B*. The frequency with which it became necessary to remove the gravel and sand, with its coating of slime, from the solutions and the time required in the operation of washing the canvas and rewashing the clean gravel and sand was such as would render this clarifier unsatisfactory.

At *E* in Fig. 1 is shown the grating which supports the clarifying medium, and at *A* is shown the space for collecting the clarified solution from which it is carried away by *C*; *D* is rope calking for the canvas.

Notwithstanding the fact that experimentation, as far as permissible during alterations, was carried on with sand of various degrees of fineness, layers of varying thickness, and vacuum at *A* of varying intensities up to 21 in., this type under the best conditions failed to give a rate of flow sufficient to handle the tonnage required of it. The passages under the grating were ample to afford ready escape of the solution and consequently did not influence the capacity.

By slight alteration, after about 10 days' trial, it was remodeled as shown in Fig. 2, after which no further difficulty was experienced. The grating *E* was raised about 11 in. in the clear, being supported by blocks *I*, 4x4 in.; vertical box launder *H* was placed in position; *C'* extended upward and was used as an overflow pipe; the excelsior *F* was covered by a screen *G* which was in turn held in place by cleats *M*. As indicated by the arrows, the solution passes from the feed pipe down through *H* to *A'*, where its velocity is reduced, permitting the settlement of a small portion of slime before the solution rises through the excelsior, finally overflowing as a clear supernatant into *C'* from which it passes to the zinc boxes. The discharge *J* is used only during cleaning and flushing out, which are necessary about once a month. While the arrangement in Fig. 2 is an original design of mine, credit is not claimed for originality in the use of excelsior in other clarifiers.



Remodeled Sand Clarifier Using Excelsior

*General manager, Tonopah-Liberty Mining Co., Tonopah, Nev.

In taking and recording data for underground construction of any sort, and in making computations for the direction and carrying out of such work, care should be taken to have the entire work in hand measure up to the necessary degree of accuracy, but much time is often wasted in doing certain parts of the work with too great accuracy, and not enough consideration given to the limit that can be reached by the men doing the actual construction. The planning and actual performance bear a certain definite relation to each other, and it is useless to compute to an error of 1 in 10,000 if the work cannot be done with an error less than 1 in five hundred.

Taper of Face of Car Wheels

A flat-tread, straight-flanged wheel, in going around a curve that has a short radius, climbs out over the outside rail. It requires more energy to move a car mounted thus than is required if the wheels are properly shaped, writes A. W. J. Stewart.

In designing mine-car wheels the curve of least radius of the track should be taken to get the taper for the face of the wheels.

Take the radius of the curve of the inside rail and the diameter of the wheel; then draw an isosceles triangle whose base is equal to the diameter of the wheel and whose altitude equals the radius of the curve. Lines taken from the extremities of the base to the curve center, forming the hypotenuse, will give the cone or taper for the face of the wheel.

By making a drawing to scale, and setting a bevel to the drawing and using the bevel as a guide in turning out the chill and finishing the pattern, one should be able to get wheels that would give satisfaction.

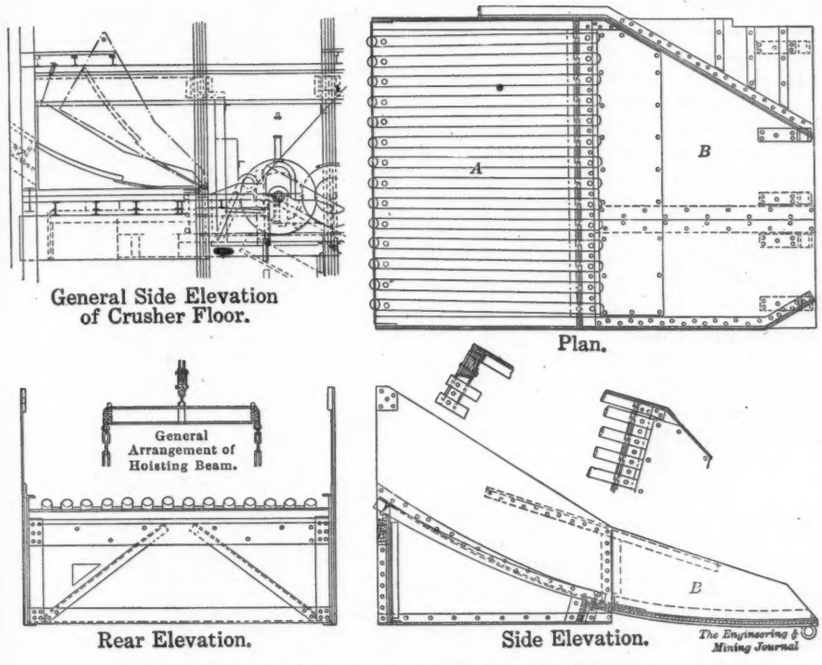
Of course, one should consider the curve of least radius, if there are others around which the car is to be moved.

A wheel with more taper than is absolutely needed is preferable, in fact it is advisable to put a little more taper in the face than indicated. The flange should lean back, as it were, and have a large fillet, the radius of which is greater than that of the corner of the top of the rail and which the wheel is to run.

Feeding Boulders to Crushers

By Claude T. Rice

In the mining of orebodies having strong walls, especially if the ore is not to be drawn through chutes, it is advantageous to break it as coarse as possible in the stope and do the crushing at the surface. At the Calumet & Hecla mines, where the orebodies dip at about 38 deg., the ore is loaded directly from sollars at the bottom of the stope into low tram cars of 2½ tons capacity. These are built so that large boulders, often weighing a ton or more, can be rolled into the car, and as the cars are dumped directly into the skips, which hold about 7 tons, no difficulty arises until it comes to the crushing and handling of the boulders at the surface.



Grizzly and Apron for Feeding Crushers

During the last two years this difficulty has been overcome by the use of an apron grizzly on which the skip dumps and by the raising of which the ore is poured into the Blake crushers which are capable of taking a boulder 24x48 in. in section. This the crusher does without any apparent strain, and at one operation the ore is crushed to four inches.

The skip at the Red Jacket shaft, where the first of these aprons was installed, dumps at right angles to the apron grizzly so that the ore is not evenly distributed across the grizzly but tends to pile up more on the far side. At the other ore houses, where this system of handling the ore is used, the skips dump lengthwise upon an apron protected from wear by old rails.

In the apron feeder used at the Red Jacket shaft, owing to the space available, the grizzly is an integral part of the feeder, but in the later installation the grizzly bars are stationary and longer, so that the undersize is screened thoroughly before the apron of the feeder is reached. This is the more desirable design where the space available permits such an arrangement.

The apron consists of two parts, the grizzly *A* and the apron *B*, shown in the accompanying illustration, to which at the upper end is fastened the hoisting beam that is raised by a winch, belt driven from the main shaft of the ore house. These two parts are laid off on different curves. The upper part of the apron is steeper than the lower; as a result, the ore from behind pushes that in front forward when the apron is raised so that the ore works forward only as fast as the ore in front passes through the crusher. This entire device is hinged at the bottom to the frame of the ore house, while a counterbalance weighing about 3600 lb. is used to take practically all the weight of the apron from the winch that raises it during the feeding of the ore. In raising the apron a block and tackle arrangement of lifting the cable is used, and on the shaft, to which the hoisting winch is connected by a friction grip, when desired, a band brake is fitted so that the apron stays in any position as soon as the friction clutch is thrown out.

The grizzly bars are spaced 4 in. apart and are made round, as the ore is less apt to clog them than if a bar of V section were used. The ore breaks in long thin pieces which pass part way through and then topple over, causing binding on the side.

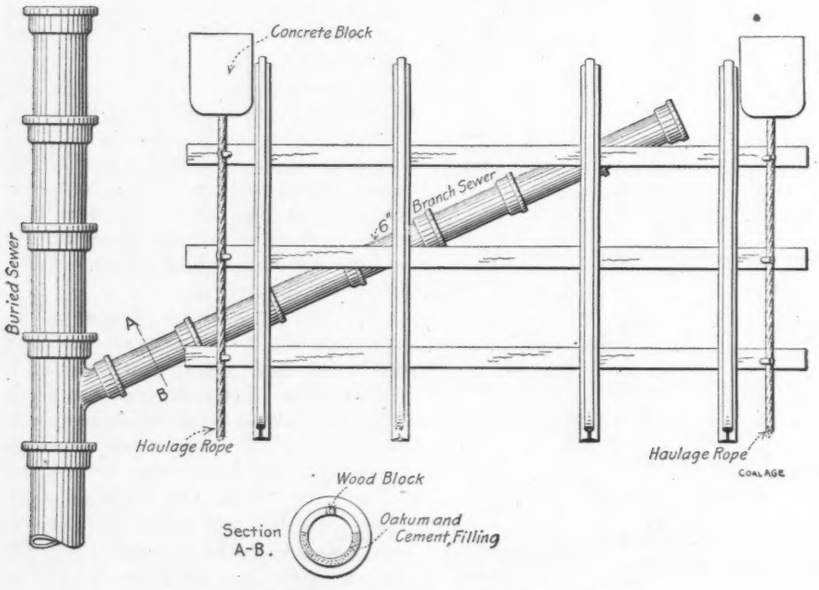
The ore from the conglomerate mines contains rock from the hanging wall, which has to be removed by sorting. This is easily done when the apron is in the lowered position, as the ore lies in a thin layer upon it. Two men do the sorting before the apron is raised to its second position about half way up. The rock is thrown aside and crushed for road metal. In the case of a boulder too large for the crushers, a chain is put around it and it is raised by a winch, with which each of the breakers is provided, and is swung aside and put on a flat sheet, where the men at odd times break it up by gad and hammer so that the pieces will be small enough to enter the crusher.

In order to prevent the ore from rushing down and jamming in the mouth of the breaker, a log is attached to the end of a chain so that the log can easily be raised out of the way as soon as the skip is dumped. As soon as the waste has been sorted, the apron is raised half way up and the ore from behind allowed to push the ore in front ahead until most of

it has worked forward into the lower, flatter portion of the apron. Then the apron is raised to the limit of its motion, the upper part assuming an angle approaching 70 deg., then the rest of the ore slips ahead gradually into the breaker. The limit positions of the apron are shown in the illustration.

Two of these aprons are used, one for each skip, so that as it takes only about 2½ min. to feed a skipload of 7 tons, over 60 per cent. of which is too large to pass the grizzly; the apron is always ready before the skip returns. At the final stage of dumping the feeder attendant removes any jammed ore from the bars with hooks. In a test at one of the amygdaloid mines four men fed 104 tons per hour through the breakers for four hours.

Taken as a whole, where the ore to be crushed contains large boulders and



DRAINING A GRAVITY PLANE WITH SEWER PIPE

where it is necessary to remove the coarser pieces of waste, this arrangement of an apron feeder seems most admirable, and the best possible solution of the problem. It permits the waste to be sorted, the ore to be fed gradually to the crushers, any boulders too large for the crushers to be removed easily, and avoids any handling of the ore in getting it into the crushers, even when it contains boulders as large as a ton and a half in weight.

At the amygdaloid mines the aprons upon which the skips dump can be raised so that waste is dumped directly into the waste bin. No hoisting beam is used, but instead a chain with a pipe spreader-bar to make the chain pull straight upward for a sufficient distance so that boulders will not catch on it, is used. The block hooks into a ring on this chain. This is a cheaper construction and fully as good as the beam. Owing to the counterbalancing little power is required to raise the apron feeder, and so there is no apparent effect on the meter of the 100-h.p. motor that drives the crushers when the apron load is thrown on it.

Draining Gravity Planes

The best plan to drain a gravity plane and keep the track ties in place is to lay a line of tile-pipe on one side of the track with properly cemented joints. All the water that can be diverted from the head of the plane should pass down this drain. Several wyes should be put in the line and 6-in. branches run from these under the track. These branches should be cemented on the under half. The upper half should be left uncemented so as to drain the roadbed. Cover the ditches in which the branch pipes are laid, with broken stone.

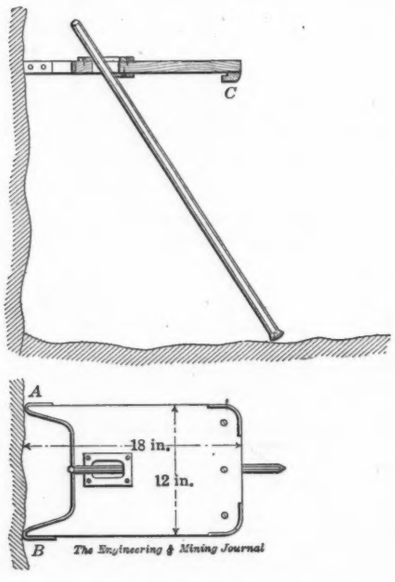
Some planes are laid with anchored wood-sills into which the cross-ties are notched. The notching results in speedy rotting of the timber and the expense of such a method is considerable. The use of long ties common to both tracks as shown in the accompanying sketch is recommended by *Coal Age*, but perhaps the best security and the cheapest is the use of a haulage rope spiked to the end of ties and secured to a heavy timber, masonry or concrete support at the head of the plane. If the plane is long, two or three of these may be necessary so as to divide up the expansion from heat. Old, discarded ropes will do, and a heavy coat of tar will prevent them from rusting away; this coat being applied before and after their attachment to the ties.

A Portable Desk

BY A. LIVINGSTONE OKE*

The accompanying sketch shows a desk for use when surveying and sampling in mines. It consists of a board about 18 in. long and 12 in. wide with an oblong hole cut near one of the shorter sides. Through this hole a long piece of drill steel is passed, as shown, so that the two points *A* and *B* rest against the wall of the level or stope, as the case may be. These, with the point of the drill steel, form a three-point support for the board, on which a lamp can be placed, and it is possible to write in the notebook, when sampling or surveying, with the same facility as at an ordinary table.

In a mine it is always easy to find a suitable length of drill steel, so all that has to be carried from place to place is the board. This board requires to be strengthened by strips of iron around the



MINE SURVEYOR'S DESK

points and the hole should be reinforced with an iron plate above and a strip below, where the weight of the table bears on the drill steel. The height is easily adjustable and the cutting out of the board, between the points *A* and *B* affords a steady rest on the most irregular surface.

The strip of wood shown at *C* on the lower outer edge of the board, is recessed at the back, as shown, and serves as a grip for the fingers when carrying the desk.

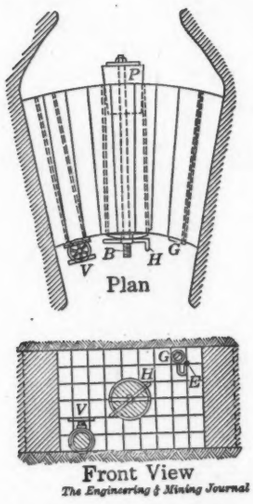
If desired, a small box may be attached to the lower side, in which notebooks, pencils, etc., may be placed. The desk makes a convenient stand for an acetylene lamp which may be placed at the back when writing.

*Resident manager, San Juan Mines, Ltd., Rodeo, San Juan, Argentine.

Timber Dam for Mine Use

There are several forms of underground dams used to resist a heavy pressure of water, but two types which are most common are those made of brick and cement, or of timber. For effectually withstanding a water pressure of 100 lb. per sq.in., to be put in a drift 8 ft. wide and 6 ft. high, the wooden or frame dam shown in the accompanying illustration is to be preferred says *Mining Engineering*. It is built of sound oak, thoroughly seasoned and dressed to shape and size required in wedge-shaped pieces 9 ft. long. The taper given to each piece would depend upon the proposed radius of sweep.

The dam should be built in solid ground, and the sides and roof of the site should be dressed off perfectly smooth with hammers, picks and wedges. No explosives should be used in the preparation of the site in order to avoid shattering the rock. In the end nearest the water each side should be enlarged two feet, making a total width of 12 ft. The floor and roof should be enlarged one foot, making the total height 8 ft. The area of the dam nearest to the water would then be 96 sq. ft., and the other end (8 ft. wide and 6 ft. high) 48 sq. ft. The oak pieces would be prepared, fitted together and numbered at the surface before being sent into the mine to insure good tight joints when permanently fixed.



TIMBER DAM FOR DRIFT

Before the building of the dam is commenced, a thick layer of tarred flannel is put against the sides and bottom, on which the tapered pieces are put with the thick ends toward the water. Tarred flannel should also be put between the balks to insure the dam being watertight.

If any water is present during the construction of the dam, pipes must be provided and placed at the bottom of the dam to allow it to escape. The size of the pipe will depend on the quantity of water given off. As seen in the illustration there are three pipes, one at the bottom for the water to escape while the dam is under construction, another in the middle, of about 18 to 20 in. diameter, to provide means of ingress and egress for the workmen, while near the top a small pipe is inserted, the purpose of which is to allow the escape of any gas. The oak pieces surrounding the pipes are shaped to fit them.

When the dam is fixed in position every joint is wedged from the side nearest the water. The wedges should be of fir, two inches long, three wide and one thick. When these wedges have been driven in, small hardwood wedges should be inserted in each joint wherever possible. When the dam is completed, the lower pipe should be fitted with a valve at the outer end, a valve is better than a plug as it need not be closed until all the men are out and the manhole closed, and the water can be run off in any desired quantity at any future time. The manhole pipe is inclosed by means of a wedge-shaped wooden plug *P* the thick end of which is covered with vulcanized rubber to insure a water-tight joint. The plug should be placed in position, so that when ready it can be drawn into the back of the pipe and pulled home by means of a long bolt *B* and handle *H*. A pressure gage *G* may be fixed to the small pipe at the top of the dam to indicate the pressure of water.

Improved Coslettizing Process

An improvement in "Coslettizing" was recently patented in England in which zinc is employed. The ordinary process of Coslettizing consists in boiling the articles of iron or steel in a solution of phosphoric acid and iron phosphate in water. Phosphoric acid may be used alone, but a longer time is required in order to produce the coating as a certain quantity of iron must be in the solution to give the deposit. By this method a dead black coating is produced on iron or steel which protects it from rusting.

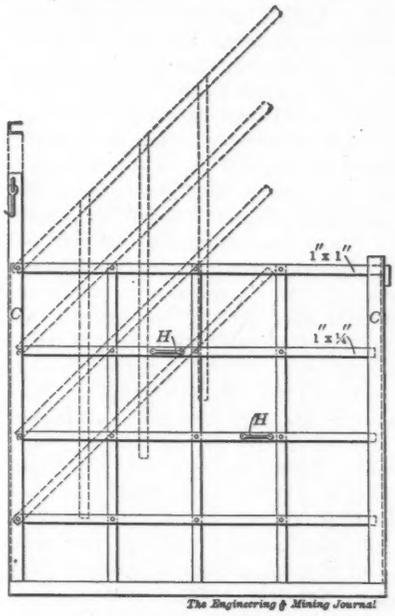
In the new process the following solution is first made up; Zinc, 6 oz., phosphoric acid, 1 pint, and water 1 pint. The solution is warmed for dissolving the zinc and is then known as the "concentrated solution." This solution is then added in the following proportion to water to produce the solution intended for regular use; Water, 1 gal., concentrated solution, 1 oz. For renewing the solution when in use, ¼ oz. of the concentrated solution is added to each gallon.

The iron or steel articles to be treated, states the *Brass World*, are boiled in the solution, contained in an iron kettle, for some time (usually about an hour) and a rustproof coating is obtained on the surface. The process may also be combined with the other in which iron phosphate is used and a combination coating obtained. The inventor states that an electric current may also be used in the operation in order to hasten it. In this case, the solution may be used cold if desired. The article to be treated is made the cathode and an iron plate is used as an anode.

A Safety Gate for Cages

BY R. B. WALLACE*

In vertical shafts an open cage is often used for hoisting men in preference to one inclosed with sheet metal. The accompanying sketch shows a gate for an open cage which gives a full opening and which can be used where there is not sufficient room for any up- and down-sliding gate.



A FOLDING SAFETY GATE

The bars of the gate are hinged on one side and fold up to a vertical position where they are held by a hook that fastens into one of the handles of the gate. The top bar is 1 in. square while the other cross bars measure 1x¼ in. These are loosely riveted together. Two channels *C* made from plate and bolted or riveted to the sides of the cage hold the gate in position. Two handles *H* are placed in convenient positions on the cross strips for the cage conductor to grasp when raising the gate.

The Mount Boppy Gold Mining Company, Ltd., New South Wales, will install a 300-ton Moore filter plant.

*Mining engineer, Republic, Mich.

Tanganyika Concessions, Limited

At the general annual meeting of the Tanganyika Concessions, Ltd., held recently in London, optimistic forecasts of the future of this company were again made by Robert Williams, managing director and Tyndale White, chairman of the company. Mr. White quoted at length from the speech of M. Jadot, made at the meeting of the Union Minière Co., dealing with question of ore reserves. This was, in substance, as follows:

Ore Reserves

Up to the present, about 100 mines have been discovered on the concessions of the Union Minère, of which the 10 following are the most important; Kambove, which is estimated by William Frecheville to show 1,800,000 tons of proved ore with an average content of 12%, or 215,000 tons copper. Mr. Atherton estimated the same mine at 2,500,000 tons of 14% ore proved, or 350,000 tons copper. Mr. Gibb estimated 3,000,000 tons of 12% ore proved, or 360,000 tons copper. Star of the Congo, Mr. Frecheville estimated 435,000 of 14% and 9% ore proved, or 50,000 tons copper. Mr. Atherton estimated 1,500,000 tons of 11% ore proved, or 165,000 tons copper. Mr. Gibb estimated 1,200,000 tons of 15 and 6½% ore proved, or 106,000 tons copper. The following are Mr. Atherton's estimates on the others of the 10 mines. Fungurume, 1,500,000 tons of 7% ore proved, or 112,000 tons copper; Kwatabala, 1,150,000 tons of 7% ore proved, or 85,500 tons copper; Likasye, 1,000,000 tons of 12% ore proved, or 120,000 tons copper; Kabalela, 1,000,000 tons of 7% ore proved, or 75,000 tons copper; Dikurwe, 800,000 tons of 12% ore proved, or 96,000 tons copper; Musonoi, 600,000 tons of 9½% ore proved or 57,000 tons copper; Kolwezi, 450,000 tons of 13% ore proved, or 60,000 tons copper; Kakanda, 350,000 tons of 9% ore proved, or 30,000 tons copper. These 10 mines give, therefore, according to different estimates, as the amount of ore proved more than 10,000,000 tons, containing about 1,000,000 tons of copper.

The address of the managing director dealt at length with smelting conditions at Lubumbashi. No coking coal was found until recently on the Tanganyika Concessions' Luano coal field, and early negotiations with the Wankie collieries (northern Rhodesia) proved fruitless, so it was finally determined to begin smelting with European coke.

Present Copper Cost, £56 per Ton

The water-jacketed furnace was blown in on June 30, 1911. Of the copper in the ore 87% was recovered as bullion, 2½% as flue dust, and 10½% lost in slag. On Oct. 6, Mr. Studt, consulting metallurgist, advised that the cost of copper at the frontier was £56, of which no less than £39 was for coke.

An agreement has been entered into with the Wankie Colliery Co. by which it is expected that a much cheaper coke supply will be obtained from the Wankie fields.

Mr. Studt also stated that difficulty was being experienced with the fine ore, of which a great proportion was blown into the dust chamber. The flue dust carried 6 to 9% copper and 8% unconsumed coke.

The Rhodesia-Katanga Co., a subsidiary, owns the Kansanshi mine, the Luongo coal fields and other properties. Operations at the Kansanshi mine showed a 5-ft. reef in the dolomite, carrying 10% copper. This mine has sent home 2000 tons of copper during the year, which, with the 1000 tons from the Lubumbashi works, makes a total of £150,000 shipped by the subsidiaries in the six months preceding the meeting.

New Iron Furnaces at Buffalo

The doubling of the iron furnaces of the Rogers-Brown Iron Co., at Buffalo, N. Y., which has been underway for about a year, is nearly completed. The two older furnaces have a capacity of 300 tons of pig iron each per day and the new ones will slightly exceed that. As yet the company has not fixed a time for blowing them in, but will do so early in the year if market conditions warrant. The company mines all the coal it uses on its own property and makes its coke, not buying or selling any.

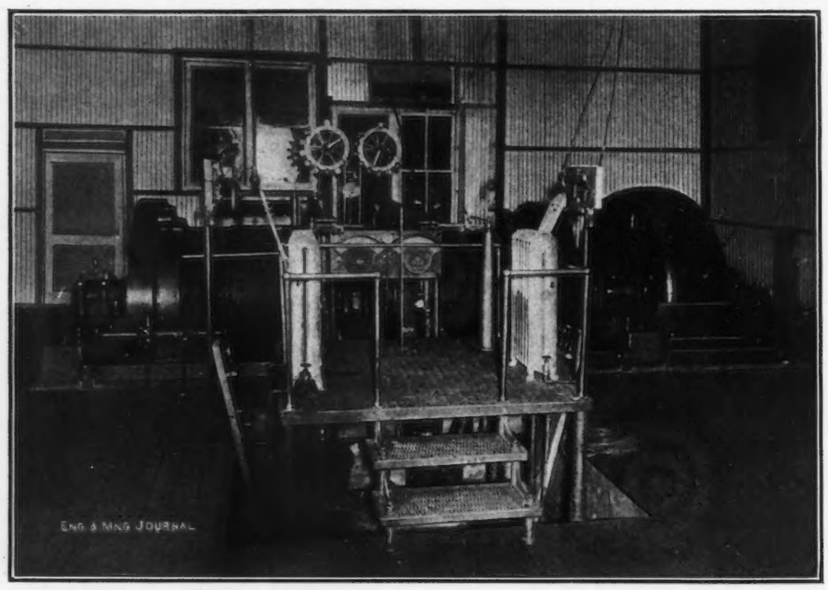
Electric Hoist at Calumet & Arizona

The Calumet & Arizona Mining Co. has recently completed an elaborate set of tests on the electric hoisting system which has been in operation since the latter part of September, 1909, at its mine in Bisbee, Ariz. The installation is reported satisfactory; the ease with which it is handled and the complete control which the operator has over it being especially noteworthy.

Tests have shown that, even under severe operating conditions where the hoist is running a great portion of the time, the average input to the system over a day's run will not exceed more than about 20 or 25% of the maximum load, and that the rate of input is practically constant.

With small hoists, it has been found satisfactory to use alternating current induction motors directly applied, but where heavy loads are to be handled and at high speed, the peak due to the acceleration of the rapidly moving parts is always greatly in excess of the average requirements of the hoist. If the current is obtained from a line also carrying a lighting load, the resulting fluctations of voltage prove most objectionable. In most cases the hoist is at the end of a long transmission line and so an excessive amount of copper must be installed to prevent drop in the voltage during maximum demand. The result is that the line must be equipped for peak instead of average load at a greatly increased expense.

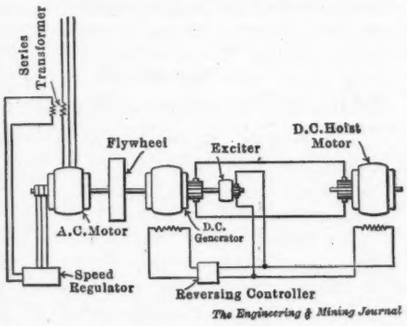
To overcome the above undesirable conditions the Westinghouse equalizer system hoisting plant was designed, the



Electric Hoist at Calumet & Arizona

essentials of which are shown in the accompanying diagram. It consists of a direct current motor, direct connected to the hoist drum and a flywheel motor-generator set which includes a direct-current generator, a laminated flywheel, an alternating current induction motor and an exciter. The equipment also includes a reversing controller for the generator field, a speed regulator, a series transformer, and a switchboard. The hoist proper was built by the Denver Engineering Works Co. and it has a normal duty of 6000 lb. unbalanced load. Its speed is 1000 ft. per minute. The ultimate depth of the shaft is 1200 feet.

The armature of the generator and the hoist motor are electrically connected direct. The field of each machine is excited separately, constant full field being maintained in the motor. The hoist is started by gradually increasing the field of the generator and so delivering a proportional voltage to the hoist motor. When the load on the alternating current motor reaches a certain point, resistance is automatically applied to its secondary circuit, reducing the speed of



EQUALIZER HOISTING SYSTEM AT CALUMET & ARIZONA

the set, and the energy stored in the flywheel is used to overcome the peak of the hoisting cycle. Thus there is a minimum use of current.

The hoist is stopped by gradually weakening the generator field and thus allowing all excess in the descending cage, the rotating hoist motor and the drums to be returned to the flywheel through the generator which momentarily acts as a motor, receiving energy from the hoist motor which for the moment acts as a generator. The overall efficiencies of hoists of this type are generally from 50 to 60% when operated under normal operating conditions.

Because of the ease of control and the general characteristics of the set, it is a simple matter to devise reliable safety devices which do not depend on mechanical brakes. Such devices have been put in practice in Germany, where the government allows men to be hoisted at a speed of 2500 ft. per minute in this type of hoist, whereas with steam hoists provided with the best available safety devices the maximum allowed speed is but 1200 ft. per minute.

The first cost of installation is, of course, somewhat greater than a small motor hoist with rheostat control, but the manufacturers claim that the reduction of power cost due to the equalization of the load is so great that the initial expenditure becomes a secondary matter, especially when power is purchased on a maximum demand system.

The accompanying cut shows the hoist motor, the drums and the operator's platform at the plant of the Calumet & Arizona Co., Bisbee, where the set consists of a Westinghouse type EM. 220-hp., 550-volt, 63-r.p.m., shunt-wound, commutating-pole, direct current motor, direct connected to the hoist drum. This receives its power from a flywheel motor-generator set which includes a Westinghouse type EM. 180-kw., 575-volt, 1200-r.p.m., shunt-wound, commutating-pole, direct current generator; a 22,700-lb. laminated flywheel; a Westinghouse type HF., 180-hp., 2200-volt, three-phase, 60-cycle, 6-pole, 1020 to 1200-r.p.m. induction motor; a Westinghouse type S 15-kw., 125-volt exciter, and the necessary controlling and regulating devices.

Keystone Mines, California

SAN FRANCISCO CORRESPONDENCE

A new incorporation, known as the Keystone Mines, has taken over the old Keystone mining properties in Amador County, Calif., and contemplates reopening the mine below the present 1200-ft. vertical depth, for the purpose of exploration to determine if there is any good ore lower than the 900-ft. level. The property was one of the early producers on the Mother lode and is credited with a production of $16,000,000 in gold. It is composed of four lode claims situated south of the Bunker Hill mine and between Amador City and Sutter Creek. Formerly the Mahoney & Wildman mine was included in the holding. In the last 10 years the mine has been worked only intermittently, and in its last operation in 1910 by the California Consolidated Mines Co., the means for systematic exploration for new orebodies was not provided, and the mine was again closed down.

During the period of idleness the property has been kept unwatered with an electrically driven pump. There is a 60-stamp mill on the property, but not of modern type; there is also a 300-hp. compressor and other smaller compressors, steam hoist, sawmill, transformer house and other essential buildings and tools. The purpose as announced by the company is to sink 200 ft. below the 1200-ft. depth before crosscutting toward the vein. The Keystone is directly in line with the Argonaut, Kennedy, Central Eureka, Amador Consolidated, Bunker Hill and other mines, some of which are mining at a depth of 2000 ft.; others at more than 3000 ft. The new company is capitalized for $500,000, and the directors are C. R. Downs, Sutter Creek, president; Julius Chichizola, Amador City; C. L. Culbert, Jackson; W. J. McGee, San Francisco.

Conditions at El Oro

The properties of the El Oro Mining & Ry. Co., Ltd., in Mexico, were examined recently by R. T. Bayliss, chairman of the board of directors, in conjunction with Messrs. Foster, Raymond and Main. Mr. Bayliss' report contains a number of interesting and important features and his recommendations were unanimously adopted by the directors. Some important changes have occurred in the underground workings and it is stated that the recent political troubles in Mexico necessitate the consideration of the conditions which may, in the future, affect the conduct of enterprises similar to the El Oro; also, that the future policy of the company must be carefully reviewed.

THE SAN RAFAEL OR MAIN VEIN

For convenience, this vein has been separated by Mr. Bayliss into two portions; the upper half includes the workings from surface to the 486-ft. level and the lower half constitutes the workings below this level. Regarding the upper portion of this vein, Mr. Bayliss says: "The ore at present exposed above the 486-ft. level limits, in my opinion, the probable production of the upper portion of the San Rafael vein. The policy which has, therefore, been decided upon is to curtail further development work above the 486-ft. level, to break out all the ore therein which can be treated at a profit, and to abandon that portion of the vein. By this means a considerable economy will be effected in the maintenance of the many miles of lateral and other drifts in this portion of the property."

The lower portion of the vein has been opened to only a limited extent in the northern part of the property and with the exception of the 1000-ft. level south of the Somera shaft, has been practically unexplored. It is stated that while drifts opened from the 486 to the 1000 level north of the Somera shaft and extended to the northern boundary, have been somewhat disappointing, it is not safe to assume that the large area below the 486-ft. level, from the Somera shaft to the southern boundary is going to be unproductive until it has been proved so. The more recent workings on the 1000-, 1150- and 1300-ft. levels to the north of the Somera shaft show a material improvement in appearance, which is said to justify the expectation that

it will be found more productive below the 1000-ft. level than between that level and the 550 above. No commercial ore has been exposed in the impoverished zone between these two levels. The first indications of improvement were on the 1000-ft. level where a small body of payable ore was found. The appearance and grade improved on the 1150, and on the 1300 the main vein contains an orebody 120 ft. long, averaging $9.50 per ton. This is the first orebody of substantial size and value that has been encountered below the 550-ft. level. Mr. Bayliss regards the persistent development of this vein on and below the present lowest levels as fully justified and as an essential feature in the future policy of exploration.

The West and San Patricio Veins

During the last few months the developments on this vein are stated to have been most satisfactory and are continuing so. The orebody discovered on the 1000-ft. level is continuous from the 786- to the 1300-ft. level. This vein is composed of high-grade streaks occurring irregularly as to form and grade; the whole mass, as broken, including impregnated country rock, forms a fairly regular occurrence of ore that averages about $17 per ton. The relation between this and the San Rafael vein is not known, but an apparent junction at some point between the 1000- and 1150-ft. levels is indicated. Mr. Bayliss says that there is every inducement to develop this vein at further depth and that in general he regards the development of the lower portion of the northern end of the mine as offering the most attractive prospects yet presented in the San Rafael and adjacent veins.

From the No. 2 level to surface and from the San Patricio shaft to the north boundary of the Somera claim the San Patricio vein has presented a continuous orebody; between Nos. 2 and 3 levels the grade of the ore has diminished, and on No. 4 level, 150 ft. below, no orebody has so far been encountered. There is still considerable ore to be extracted between No. 3 level and surface and development on and below No. 6 level will be continued. Mr. Bayliss states, however, that he is not especially sanguine as to the speedy encountering of improved conditions. He believes that more favorable ground for operations exists in the southern portion of the vein from the shaft to the boundary of the Somera claim, providing the vein is found to continue for that distance and that he sees no reason to suppose that it will not so continue.

Victoria or No. 4 Vein

It is his opinion, also, that the Victoria or No. 4 vein holds out prospects of being a large producer. At the point of its intersection by the main crosscut through the Somera claim, an orebody 550 ft. long and 8 ft. wide has been exposed; while this is low grade, it can be treated at a satisfactory profit. It is believed that this vein is identical with the Victoria vein developed some years ago in the southern end of the Somera claim; if this proves to be the case, it is stated that there is every reason to believe that it will make an important mine.

Future Policy

The report states that after due consideration and deliberation the conclusion has been reached that good mining practice and a recognition of the commercial aspect of the undertaking call for some modification of the policy hitherto in force. In this connection Mr. Bayliss says:

> In arriving at a decision, we have to consider (1) the physical condition of the mine; (2) the effect which the recent political upheaval in the Republic will have upon the operation of this and other similar companies; (3) the imperative necessity of so adjusting our output that time will be afforded for the complete development of the lower levels of the San Rafael vein and all other mines owned by the company. The upper portion of the San Rafael vein cannot be expected to produce large quantities of ore after, say three years from this date. We cannot rely with absolute certainty on the San Patricio vein affording relief in the immediate future. We cannot foresee, before the expiration of the period mentioned, the development of any large tonnage in the bottom of the mine to take the place of these two sources of supply.
>
> There is imposed upon us, therefore, the obligation of husbanding our resources, in order to get time for the full completion of the scheme of development which we have in view. For this reason we are of the opinion that the best interests of the company will be served by a reduction, rather than an increase, in the monthly extraction of ore from the mine.

It is further stated that there exists at present a general feeling of unrest among the laboring classes and business community in the Republic which will result in somewhat increased cost of operation; that while these conditions may not be permanent they will undoubtedly prevail for some time. Further reduction in working expenses cannot be looked forward to with prudence, or to being able to treat a lower grade of ore than exists in the mine today. Time must be given for the full scheme of development proposed and in conclusion Mr. Bayliss states:

> The history of this company has proved that no indication of the existence of a vein is too insignificant to follow. The remarkable discoveries of the past give me the greatest confidence that the energetic scheme of development which we have agreed upon, if extended over a period of three or four years, will result in the addition, during that time, of a large tonnage of ore to the resources at present at our disposal, and at its termination, to the exposure in the San Rafael and other mines belonging to the company, of reserves of ore which will enable the company to continue its operations for a period considerably in excess of that which I am now discussing. Giving careful consideration and due weight to the points I have mentioned, we have come to the decision that, as approximately from Jan. 1, 1912, the extraction of ore from the mines should be limited to about 20,000 tons per month. That, in addition thereto, approximately 15,000 tons of the accumulated tailings, which are estimated to yield a profit of $1.50 per ton, should be treated in conjunction with the ore to be taken from the mine, making in all a total monthly output of 35,000 tons.
>
> The adoption of this policy will be of twofold benefit. It will give relief to the mine and extend the life of the ore at present exposed, to an extent that will provide for the fulfillment of the scheme of development we have in view. It will further enable us to work, to the best advantage, the large pile of tailings, which are deteriorating owing to exposure, and which would not yield, in five years' time, anything like the profit which can be earned from their treatment today. Should this policy commend itself to the board, as we trust it may, it will be apparent that the present rate of profit earned by the company of, roundly, £200,000 per annum, cannot be maintained. We have no hesitation, however, in saying that if our suggestion is adopted, the profits earned, under the scale of operations we propose, will amount to £150,000 per annum.

Mineral Resources of Kentucky

The biennial report of the Kentucky Geological Survey, shortly to be issued, covers the geological, chemical, soil and topographic work done in 1910 and 1911.

The field work for reports on the Central City, Madisonville, Calhoun and Newburg quadrangles (embracing an area of about 800 square miles in the heart of the western coal field), was completed in the spring of 1910. The work revealed a larger number of workable coals in the upper series of beds and larger fields of workable thick coals than was known to exist.

The work in Rockcastle County revealed extensive beds of high-grade limestone and sandstone, valuable deposits of clay and three seams of coal estimated at 176,000,000 tons yet to be recovered.

In the region drained by the quicksand creeks lying in Breathitt and parts of Knott and Floyd Counties occur 11 beds of coal. The survey estimates that the quantity of recoverable coal is 956,000,000 tons. A partial examination of the Beattyville coal area was made. It was found that coal with an average thickness of 36 in. underlies more than half of Lee County.

Considerable work was done in the study of oil and gas possibilities in several parts of the state. Favorable structure was found in Knott, Floyd, Rockcastle, Lewis and Rowan Counties.

The rock phosphate deposits of central Kentucky were investigated and a large

area of commercial phosphate determined. The barytes deposits of central Kentucky are reported to contain 150 workable veins, the average length being about one mile and average depth, 250 ft. It is claimed that this is the greatest barytes district in the United States.

Accidents in Cornish Mines

BY R. H. COULSON*

The British Royal Commission on Metalliferous Mines and Quarries has not yet completed its labors. At a recent sitting, evidence was submitted by J. Paull, of the South Crofty mines, Carn Brea; William James, of the Dolcoath mine; Joseph Jennings, of East Pool and Agar United mines, Carn Brea; B. Nicholas, of the Levant mine, Pendeen. All agreed that many of the accidents are due to carelessness and familiarity, but they do not see how this class of accidents is to be prevented by anyone but the employees themselves.

BLASTING CERTIFICATES URGED

Mr. Paull had something to say regarding the present law in respect of the quantity of explosives allowed to one person, and the method of conveyance and storing below ground. The law requires attention, and persons without a knowledge of charging holes and blasting should not be allowed to use explosives except under the personal direction of one who had experience, while miners should be required to have blasting certificates.

Rock drilling, in the view of Mr. Paull, is no doubt injurious unless certain precautions are taken to prevent inhaling the dust, but if the miner will take reasonable care of himself, there need be little or no danger. The present spray is bad, a jet being preferable if plenty of water is available; but if compelled to run a rock drill himself, this witness would prefer wearing a simple piece of sponge for a respirator to using either a jet or a spray. In brief, his conclusion is that drills in confined spaces should be worked with water, that respirators are a useful adjunct, and that a piece of sponge is best.

ADVANTAGES OF ACETYLENE LAMPS

He does not see that more can be done in the way of prevention against accidents beyond having stronger lights, such as acetylene. He favors the compulsory use of acetylene lamps to a certain extent, but does not think it would be well to insist upon every man having one, owing to the difficulty of fixing it while working. One of the commissioners, remarking that the cost when using acetylene lamps is only about one-third of that of candles, the president, Sir Henry Cunynghame, said it was incredible in that case that they are not more largely used. Mr. Paull added that the cost with the lamp he had in mind was more than that, but the small American lamps, as generally used, which give a much better light than the candles, consumed little carbide.

The suggestion was made that power be given to the men to appoint representatives to make an inspection of the mines, as is done in the coal mines of Great Britain. Mr. Paull can see no advantage to be gained thereby, considering that the present system of holding the chief man in each working place responsible is the better one, with, of course, frequent inspections by the managers and foremen. Mr. James also disapproves the suggestion, believing that such a provision would lead to a great deal of dissension among the miners themselves. It has to be remembered that the conditions in the tin mines of Cornwall differ considerably from those of coal mines. To this view Mr. Jennings added that the proposal would be distasteful to the men and impracticable for Cornish mines, for no one knew the sides and roof like the man in charge.

The provision of two shafts was proposed. Mr. Paull does not think this should be compulsory, provided that where there is only one outlet and there is no danger from explosive gas, it is divided into two or more compartments; and that in addition to ordinary hoisting arrangements a good ladderway is provided as a second means of egress in case of accidents to the winding arrangements.

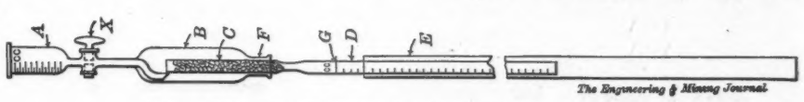
Much the same view was expressed by the other witnesses, and while admitting that double shafts are "useful" for mines, Mr. Nicholas says that if an act of Parliament is passed compelling every mine to have two shafts, it will throw a heavy burden on a great number of them, rather more, he is afraid, than some of the mines can carry. In some cases money may be found to put down one shaft to try a mining property, but if compelled to put down two the money may not so easily be found, if at all. As far as his district is concerned, it is absolutely unnecessary. For the last 15 years Mr. Nicholas has been a mine official, having superintended mining operations in the Transvaal, Brazil, Italy, in the Camborne district, besides nearly four years in his present position. He has never seen the time nor place where this idea of two shafts would be of any benefit to the metalliferous mines or to the miners themselves.

*20 Hornby St., Wigan, Eng.

Metallic Zinc in Zinc Dust

The value of commercial zinc dust depends on its content of metallic zinc. Various methods have been proposed for the determination of the metallic zinc without interference from the zinc oxide; among these may be mentioned the evolution of hydrogen from the dust by sulphuric-acid treatment with direct measurement of the hydrogen,[1] evolution and burning of hydrogen and determination of the water formed,[2] reduction of standard potassium-bichromate solution in sulphuric-acid solution with titration of the residual solution with standard ferrous sulphate,[3] and reduction of potassium iodate in caustic-potash solution and determination of the reduced iodine, $3\,Zn + KIO_3 = 3\,ZnO + KI$.[4]

A works method is suggested as follows: Remove iron from the sample with a magnet, and weigh out 0.5 or 1 gram of the treated sample, or if a large amount of iron has been removed, a portion equivalent to 0.5 or 1 gram of the original sample. Treat with an excess of neutral copper-sulphate solution, stirring well with a glass rod and allowing to stand for some time. Filter over asbestos in a Gooch crucible, and wash thoroughly. Determine the copper on the filter, and calculate the zinc. (Cu = 63.57, Zn = 65.37.) Metallic lead will, of course, interfere, but owing to its high atomic weight (207.1), it requires over 3% of lead to appear equal to 1% of zinc. Moreover, in zinc dust used as a precipitant in cyanide mills, the lead would be available for precipitation and this method appears to give the true reduction equivalent of the dust.



BURETTE FOR ZINC-DUST ANALYSIS BY GAS EVOLUTION

In case the evolution method, with measurement of the evolved hydrogen, is preferred, what appears to be an elegant piece of apparatus has recently been devised by R. F. Bacon and P. B. Dunbar[5]. The instrument, shown in the accompanying illustration, is, of course, used in a vertical position. It consists of a graduated funnel tube *A;* a reaction chamber *B;* an absorption tube *C,* filled with glass beads; a eudiometer *D,* and a leveling tube *E.* The absorption tube *C* is sealed onto the eudiometer, and fits into the reaction chamber *B,* by the ground joint *F.* To use this apparatus, place a weighed

[1]Barnes, Journ. Soc. Chem. Ind., Vol. 5, p. 145.

[2]Fresenius, "Quantitative Analysis," II, 452, sixth edition.

[3]Ibid, II, 453.

[4]Sutton, "Volumetric Analysis," p. 382, tenth edition.

[5]Journ. Ind. and Eng. Chem., Dec., 1911, p. 931.

quantity of zinc dust in *B*, open cock *X*, and bring the liquid, in this case dilute sulphuric acid, to the zero mark *G*. Close *X* and place about 15 c.c. dilute sulphuric acid in the reservoir *A*. Lower the leveling tube so that the air in the apparatus is under reduced pressure, and run in exactly 10 c.c. of the acid from *A*. Place an electric heating coil around *B*, and heat until the reaction is complete. Allow to stand until the apparatus has reached room temperature, bring the gas in the apparatus to normal pressure by means of the leveling tube, and the burette reading is the amount of gas evolved.

The London Gold Market

The annual circular of Messrs. Pixley & Abell, of London, says that there is little of interest on which to comment in the movements of gold during 1911, foreign exchanges generally not having reached a point where gold shipments from this country have been profitable, while neither the Morocco crisis nor the Italian-Turkish war had any material effect on the movements of gold in this country. As a result the price of gold has been fixed at 77s. 9d. throughout the year, with the exception of a short period of 14 days from Jan. 2 to Jan. 15 when a demand for both Germany and Holland created a premium of ⅛d. The bank rate shows a somewhat lower average for 1911 at 3.468 per cent. as against 3.723 per cent. for 1910. At the commencement of the year it stood at 4½ per cent., and was reduced on Jan. 26 to 4 per cent., on Feb. 16 to 3½ per cent. and on March 9 to 3 per cent. During September, however, the withdrawals of gold for Egypt, Turkey and Brazil began to assume large proportions, and in consequence on Sept. 21 the bank rate was raised to 4 per cent. at which figure it remained until the close of the year.

The total arrivals of gold in bars, refined and unrefined, dust, amalgam, etc., amounted during 1911 to £44,586,737, being £1,781,349 in excess of the amount received last year. The chief sources from which this gold came were: South Africa, £37,220,183; India, £2,245,011; Australia and New Zealand, £1,321,724; West Africa, £996,174. The larger purchasers were: India, £7,757,250; Germany, £5,303,697; France, £4,523,542; the Netherlands, £939,429. The Bank of England took £24,149,000 in all.

The arrivals in coined sovereigns were £4,028,905, and the exports £18,594,829; against £6,717,334 imported and £24,682,858 exported in the previous year.

Egypt in 1911 took considerably less than in 1910. On the other hand she returned less to this country than in 1910. This falling off is to be attributed to the poor cotton crop and to uneasiness in commercial circles owing to failures in that country. Egypt has also been able to send an important amount, referred to below, to India.

India again absorbed gold to an important extent. During the 10 months ended Oct. 31 she imported in bars and coin £18,988,470, of which £4,885,481 was from Egypt and £3,980,304 from Australia, while during the same period she exported £2,053,112, mostly unrefined gold produced in the country. During the last two months there have been further important amounts received in that country in bars and sovereigns, the latter from Australia. The total imports of bars and sovereigns during 1910 was £18,026,984. The shipments of small bars from London to India during 1911 were £7,757,250, against £8,150,000 during 1910, while the sovereigns shipped from London amounted to £1,430,272 against £2,128,658. The only large withdrawal of foreign gold coin from the Bank in 1911 was £500,000 taken by Germany in German coin during the last fortnight.

During the last few weeks the government of China, in order to meet its pressing needs, has taken about £400,000 of gold from the hoard held in the palace and sold it abroad. The existence of this hoard, accumulated during past centuries, has long been known, but its value can only be guessed at, some estimates placing it as high as £9,000,000. It is surprising that a larger raid has not been made on this treasure.

Iron and Steel in Congress

WASHINGTON CORRESPONDENCE

The Ways and Means Committee has practically determined to report to Congress in the very near future a bill revising the tariff on iron and steel, and also the duties on lead and other metals included in the present act under the iron and steel schedule. This conclusion has been arrived at because of the recognition that Congress will not be able to do anything on woolens and cottons for a good while to come, until opportunity has been given more thoroughly to digest and understand the report of the Tariff Board on wool and woolens. Not wishing to delay all action on the tariff as long as this would imply, it has been determined to take up iron and steel first. The understanding is that the bill will place iron ore on the free list and will make reductions, running probably from 40 to 50 per cent. of existing rates of duty. It is expected to take the bill into a Democratic caucus at an early date, and secure a ratification of it there, following this by a passage in the House of Representatives after a moderate period of debate. The question whether such a bill can be passed in the Senate is an open one, but it is believed that such action is at least possible. The chief barrier to it seems to be found in the fact that the good understanding between the Democrats and progressive Republicans, which existed last spring and summer, has now been largely destroyed. Should the bill go to President Taft, it may or may not receive his signature. He had said that he would not sign any bill relating to a subject which has not been considered by the Tariff Board, but as the iron and steel schedule has been thoroughly considered by the Bureau of Corporations in connection with the general study of the iron and steel industry, the President may be brought to feel himself warranted in taking action on a bill which appeared to him reasonable in its reductions on iron and steel.

THE STEEL CORPORATION INVESTIGATION

The testimony of Andrew Carnegie before the Stanley Steel Investigating Committee during the past week is believed to close most of the public work of that committee, although a few more witnesses may be summoned to testify as to railroad rates. Mr. Stanley has expressed great regret at the departure of J. P. Morgan from the United States, it having been his desire to place Mr. Morgan on the witness stand. Some other financiers may be substituted, but there appears to be no positive intention of the sort at the present time. The Stanley committee has received a grant of $9000 more from the House of Representatives for the further prosecution of its investigations, but there is an understanding that much of this money was already payable in the form of outstanding bills, etc., due to investigators and for traveling and other expenses. The report of the committee is expected to be rendered largely on the basis of the information it now has, although it is possible that such witnesses may add slightly to the mass of material in hand. No action is expected from Congress one way or another as a result of the work of this committee.

United States Smelting to Extend Mexican Operations

Until recently, the United States Smelting, Refining & Mining Co., owning a group of mines, smelteries and refineries in the United States, confined its operations in Mexico to the Pachuca and Real del Monte districts, in the state of Hidalgo. Of late, however, an energetic campaign of enlargement in Mexico was inaugurated, and offices were opened in the City of Mexico (Rooms 411 and 412, Mutual Building), for the receipt and consideration of any data regarding such mining properties as may be in the market. This office and the field work connected with same will be under the direction of Geologist Ezequiel Ordoñez. C. W. Van Law, director of the Compañia Real del Monte y Pachuca, is the manager of all the company's interests in Mexico.

The Position on the Comstock

By George J. Young*

The discovery of a rich orebody in the Mexican mine stimulated exploratory work in other Comstock mines. Drainage and ventilation problems are being solved by co-operative methods. High-grade ore is shipped to smelteries; low grade treated in local custom mills.

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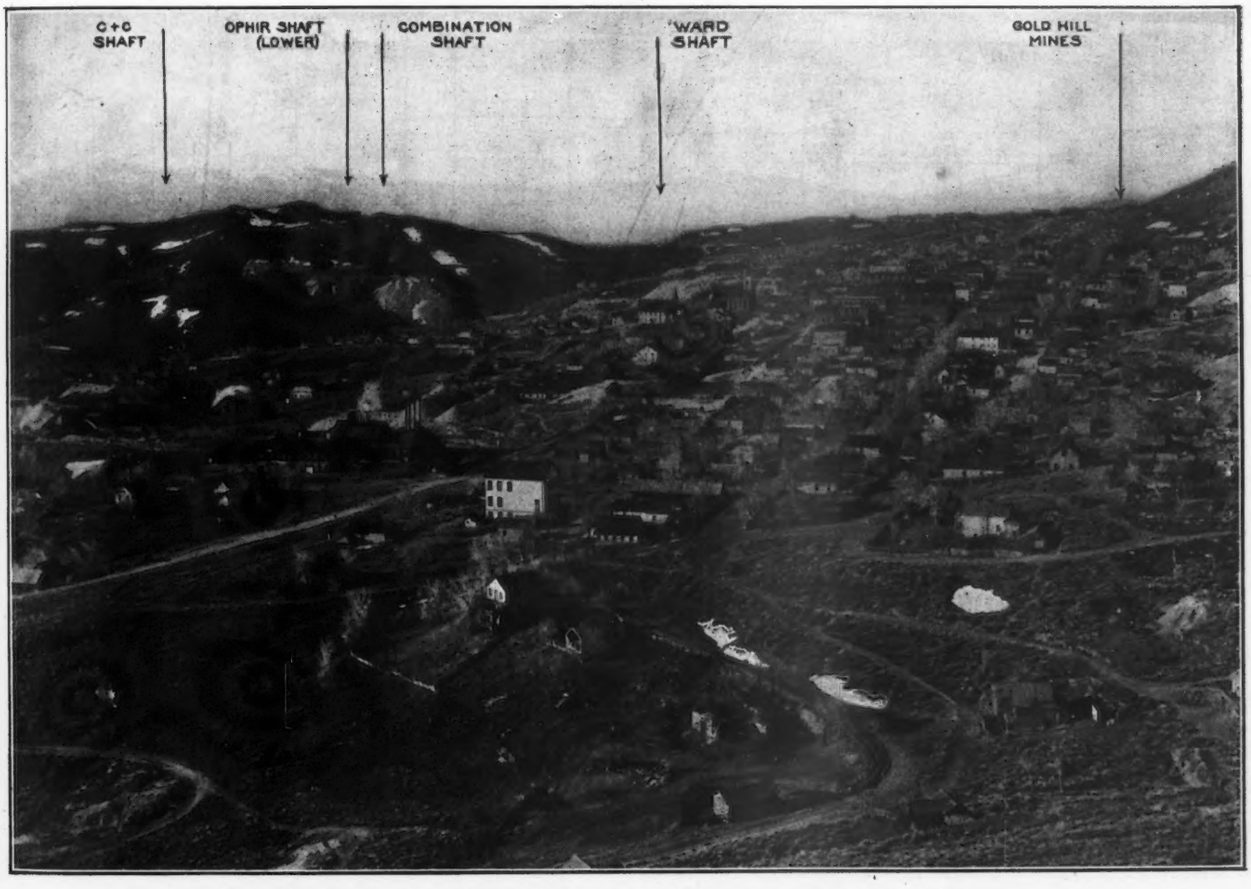
During the last year considerable attention has been directed toward Virginia City, Nev. The discovery of high-grade ore in the Mexican mine in what appears to be an orebody of some size has practically rejuvenated the Comstock. The steady, conscientious work of the last 10 years looked as if it would be for naught, and ultimate shutdown and the giving up of deep drainage and prospecting the result. It required the restoration of confidence and the invigorating with new hope not only the stockholders but also the miners and men in managerial positions. This is what the discovery of the Mexican orebody accomplished. Virginia City had redeemed itself became the current opinion.



VIEW OF VIRGINIA CITY, NEV., SHOWING THE POSITION OF THE PRINCIPAL SHAFTS

The psychology of a run-down mining camp is of interest. Everything works against those who are endeavoring to open up the mines. The past success of the camp is often in itself the principal reason for pessimism. A small setback, which, under normal conditions, would call for slight comment, is magnified until it almost stops operations. Stockholders and men lose courage. Ordinary difficulties, which could be solved by good engineering, become insurmountable obstacles. Financial difficulties are enhanced. Such a condition calls for courageous leadership. Through such vicissitudes the old Comstock has passed many times, and at critical periods some leader has appeared to start work along the road to success. Leon M. Hall became the operating leader for a while and his work pioneered the way for the solution of the drainage problem. In his steps came Whitman Symmes. This competent engineer reviewed in a noteworthy paper[1] the conditions on the Comstock and his straight-from-the-shoulder criticisms cleared the situation and prepared the way for a fresh start.

During the interim preceding the discovery of the Mexican orebody the drainage problem was worked out, and from the mistakes and accidents incident upon the work at the Ward shaft there grew definite ideas on the limitations of the problem from physical and mechanical standpoints. Despite the careful searching of the old mine records for information relative to former discoveries of orebodies in the lower levels, but little or no trustworthy information concerning these has been found. With the information at hand of a negative character, the discovery of the Mexican orebody raised a reasonable doubt as to the thoroughness of the previous explorations on the lower levels and greatly enhanced the possibilities for the discovery of additional orebodies. Geological conditions have been studied, but it is disappointing to say that, during recent years, no comprehensive review of these has been published. That this will be done and will

[1]Min. and Sci. Press, Oct. 10 and 24, 1908.

have the effect of centralizing the search for orebodies there is little doubt.

It is my purpose to review the present conditions in Virginia City. The company organizations, stock markets, etc., I do not propose to discuss. Suffice to say that the stock exchanges list about 34 mines, the stocks of which are regularly bought and sold. Large as was the Comstock lode, it is difficult to conceive of such a number of companies flourishing at the present time. It is strange indeed that the Comstock should have survived so many years with the original organizations and the separate companies.

Co-operative Drainage System

The benefits of coöperative effort were soon realized after the formation of the Comstock Pumping Association in 1898. Twenty-four companies combined, each to pay its proportional part of the expense, for establishing a general drainage system. The present United Comstock Pumping Association is the outgrowth of the original pumping organization and the Ward Shaft Pumping Association (formed in 1903). The success of these organizations is shown by the fact that the levels below the Sutro tunnel have been regained on the north-end mines to the 2500 (2650 of the C. & C. shaft) for a lateral distance extending from the Con Virginia workings through to the Union mine.

At the C. & C. shaft the water level has been depressed to the 2650 station; at the Combination shaft to a point 240 ft. below the Sutro tunnel; at the Ward shaft to the 2475 level, and in the Crown Point and Yellow Jacket mines to the 1400 level (Sutro tunnel level of the Gold Hill mines). Pumping machinery has been ordered for the unwatering and recovery of the levels of the north-end mines to the 2700 level. At the Ward efforts are being made to tap the water in the Gold Hill mines. Thirteen years have been required for this work since the inception of the Comstock Pumping Association and, barring unlooked for accidents, the early recovery of the 3000 level from Gold Hill to the Union shaft may be expected.

The present status of the drainage problem is as follows: The Sutro tunnel, the main drainage adit, has been repaired and is in excellent condition. Wooden stave pipe has been laid throughout the main tunnel and laterals to both the Ward and C. & C. shafts. A short length only needs to be constructed to the Combination shaft in the event of that shaft being required for drainage. At the C. & C. shaft the three Riedler pumps on the 2150 level are in good condition, and almost continuously operated. They have a capacity of 4500 gal. per min. Three 1500-gal. multistage bronze pumps have been ordered for the 2450 station and two 2250-gal. pumps of the same type for the 2650 station (C. & C. shaft). Two similar pumps of 2250-gal. capacity have been ordered for the 2700 level of the joint Mexican and Ophir winze. This information is shown in the accompanying table.

The entire installation will be electrically operated. The hydraulic elevator, at present in use, will be discarded or used only for emergency purposes as soon as the above installation is in operation.

At the Ward shaft two pumping stations have been constructed and are in operating condition. On the 2475 station are two 1000-gal. quintuplex, single-acting plunger pumps, and the foundation for a third has been constructed. The 2100 station has been equipped with three 1000-gal. pumps of the same type. These are listed in the accompanying table.

The Ward shaft pumps are also electrically driven. The shaft is equipped with bailing tanks for emergencies. An auxiliary pumping plant, together with the pumps on the 2100 station, is being operated and will be continued until the water from the south reaches the shaft. North and south drifts from the 2000 and 2450 levels of the Ward are being run and are already draining off some of the water surrounding the Ward shaft. Diamond drilling precedes the work of drifting, and every precaution to prevent and control a sudden inrush of water is being taken. The installations have been well designed and substantially constructed, and it is to be expected that they will not only serve the purpose, but will be

MEXICAN, OPHIR AND C. & C. PUMPING EQUIPMENT

Level	Number of Units	Gallons per Min.		Lift Feet
		Capacity of Each	Total Capacity	
2700 Mex. & Ophir	2	2250	4500	200
2650 C. & C	2	2250	4500	200
2450 C. & C	3	1500	4500	300
2150 C. & C	3	1500	4500	400
To Sutro tunnel	10		4500	1100

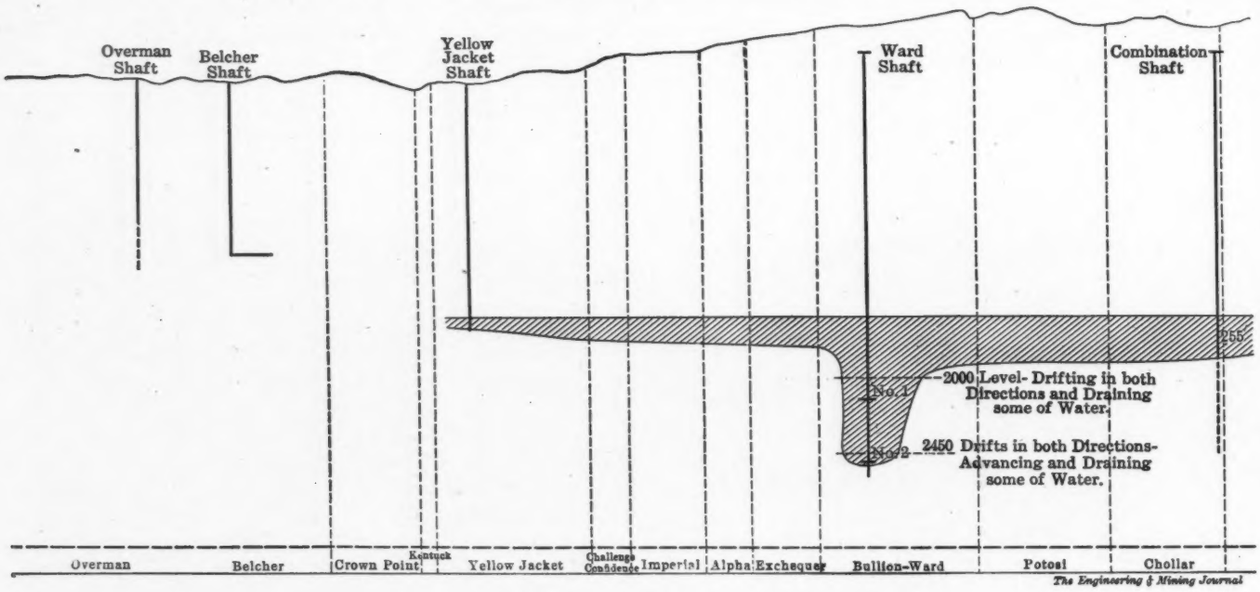


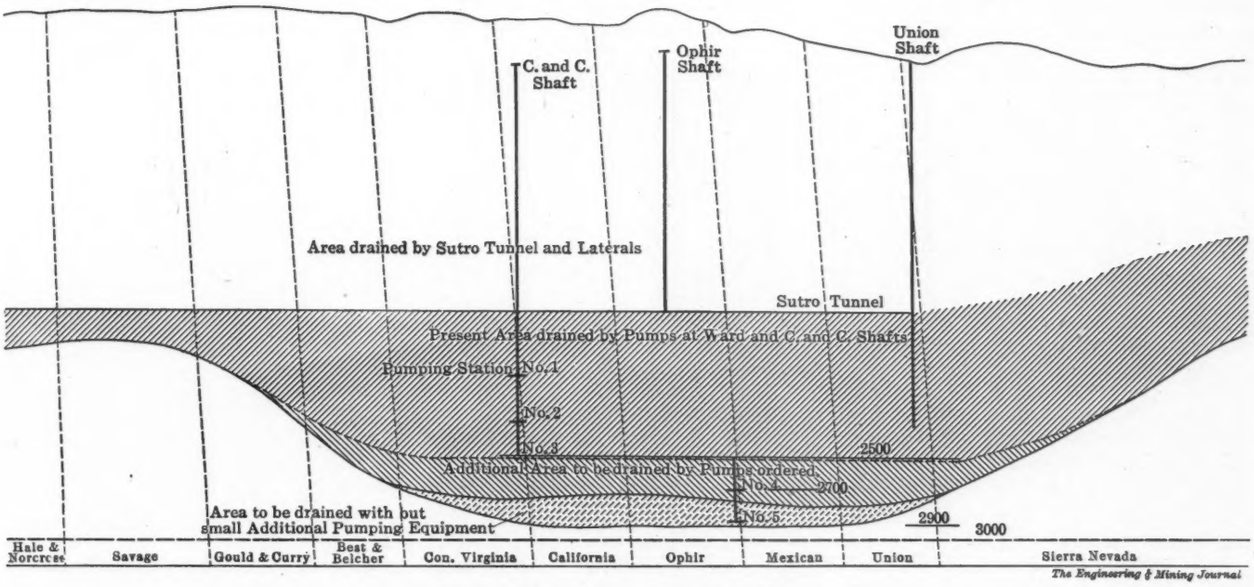
Diagram Showing the Drainage

operated with economy. The recovery and equipment of the Ward shaft reflects high credit upon Superintendent Symmes. The cost of operating the pumping equipment at the Ward and C. & C. shafts when complete will be approximately $250,000 per annum (not including maintenance of workings).

Some improvement can be made at the present time. The upcast and downcast areas are sufficient but the connecting crosscuts and winzes offer considerable resistance to the passage of an adequate ventilating current. By enlarging these more air can be drawn through the workings and lower temperatures obtained.

WARD PUMPING EQUIPMENT

Level or station	Number of Units	Gallons per Minute: Capacity of Each	Gallons per Minute: Total Capacity	Lift Feet
Sump-air lift	2	1000	2000	414
2475 station	3	1000	3000	488
2100 station	5		3000	902
To Sutro tunnel				



SYSTEM USED AT THE COMSTOCK MINES

VENTILATION PROBLEM IMPORTANT

The ventilation of the lower workings is at present not as satisfactory as it could be made. In the Mexican mine the workings are, for the most part, cool and the system well worked out. The Ophir shaft is the upcast for the north-end mines. The Union and C. & C. shafts are downcasts for the same group. The Mint and Alta shafts serve as downcasts for the Sutro tunnel laterals and the Combination is the upcast for both laterals and the main tunnel. The Sutro tunnel is well ventilated, and this is due to the use of stave pipe for the handling of the drainage water. The Gold Hill mines are ventilated through the Belcher upcast and the Yellow Jacket and Overman shafts as downcasts. The present workings of the Gold Hill mines are comparatively cool.

As greater depth is obtained on the north-end mines the necessity for better ventilation will be a critical factor in the economical operation of the workings. An exhaust fan is operated at the mouth of the Ophir shaft but it is doubtful whether the effect of this fan on the lower workings is great. By concreting the top of the Ophir shaft and placing iron doors over the compartments and placing concrete stops on all of the connecting openings leading into the main airways leakage could be controlled and the fan made more effective. An alternative suggests itself and that is to install high-speed multivane fans on the Sutro tunnel level, connecting them with the upcast winze and exhausting the air from the workings and forcing it up the Ophir shaft. Bypasses could be constructed so as to resort to natural ventilation in the event of shutdowns.

Local control of temperature and ventilation is effected by the use of electrically driven steel fans and air pipe. It is not unreasonable to suppose that the ventilation of the lower workings of the north-end mines by some well worked out plan will be accomplished in the near future. Just at present the development of ore and the completion of the pumping installations have prevented any radical improvements and compelled the resort to temporary expedients. Good engineering, however, will require that the miners be given such working conditions as will enable them to work as efficiently as possible.

EXTENT OF WORKINGS OPEN

It is practically impossible to tell to what extent the old workings are open. The workings which are used and maintained in working condition may be enumerated as follows: Sutro tunnel level—The Sutro tunnel, the south lateral to the Alta shaft, the north lateral to the Union shaft, connections with the Ward, Combination and C. & C. shafts; in all, 37,000 ft. of workings.

The shafts open and in use are: Alta, 1100 ft. to connection with south lateral; Overman, 1200 ft.; Belcher, 1100 ft.; Yellow Jacket, 1400 ft.; Ward, 2563 ft.; Combination, 1840 ft.; Mint, 1400 ft.; C. & C., 2650 ft.; Ophir, 1600 ft.; and Union, 2000 ft. The aggregate footage of these shafts is 16,853 ft. Of this 10,613 ft. are used for hoisting purposes and the remainder for ventilation. The Andes shaft (175 ft.) and the Golden Gate (800 ft.) are two small shafts which are open and in use but which are not of importance at the present time.

Gold Hill Mines: The Crown Point and Yellow Jacket mines are open through the old Yellow Jacket shaft to the 1400 level and in the former mine ore is being stoped from this level. The Caledonia and Overman mines are open on the 1200 level. The aggregate footage of workings on the Gold Hill group is estimated at 10,000 feet.

North-end mines: At the Ward exploratory workings are being driven on the 2000 and 2450 levels. In the Con. Virginia, the 1650, 2450 and 2550 levels are being used; in the Ophir the 2100, 2200, 2300, 2400 and 2500 levels; in the Mexican the 2200, 2300, 2400 and 2500 levels; in the Union Consolidated the 2000 and 2500 levels; in the Andes the 70 and 175 levels, and in the Utah surface workings. The aggregate footage of workings on the north-end mines which may reasonably be expected to be maintained for drainage, ventilation and mining is 15,000 feet.

The total footage of all workings is approximately 80,000 ft. The requirements of drainage, ventilation and mining are such that it is doubtful if this footage can be materially reduced. The workings are maintained in good condition and the cost of doing this is a large proportion of the total expense.

The scale of operations of many of the companies is necessarily limited by financial reasons. Many are on an assessment basis and the ability of a company to collect determines the footage of exploratory workings run. The producing mines (recording production during the last three months) are the Ophir, Mexican, Union Consolidated, Crown Point, Yellow Jacket (dump rock), Chollar and Potosi (croppings), Gould and Curry (old surface workings) and the Justice. The mines in which more or less development is reported, with the approximate footage, are: Ophir, 50 to 60 ft. per week on the 2100, 2200, 2400 and 2500 levels; Mexican, 30 to 50 ft. per week on the 2300, 2400 and 2500 levels; Con. Virginia, 20 to 40 ft. per week on the 1650, 2450 and 2550 levels; Union Consolidated, 20 to 50 ft. per week on the 2400 and 2500 levels; Chollar Brunswick, 20 to 25 ft. per week on the 800 level; Julia Consolidated, 20 to 30 ft. per week on the 2000 level; Andes, 10 ft. per week on the 175 level; Overman, 17 to 20 ft. per week on the 1200 level; Caledonia, 10 ft. per week on the 1200 level; Crown Point, 10 to 17 ft. per week on the 1400 level; Utah, 10 ft. per week in surface tunnel.

The total footage of exploratory workings is between 1000 and 1400 ft. per month. Both the Ophir and Mexican report considerable work in ore. The most important development work is in the north-end mines in the "east vein." With the exception of the Crown Point mine the exploratory workings in the Gold Hill mines have found but little ore.

Monthly Production 15,000 Tons

The principal sources of ore production are stopes on the lower levels, mining of surface outcrops, removal of old stope fillings and the surface dumps.

ORE PRODUCTION OF SOME COMSTOCK MINES

Week ending (1911)	Ophir		Mexican		Union Consolidated		Crown Point	
	Tons	Value	Tons	Value	Tons	Value	Tons	Value
Aug. 5	212	$12,700	428	$13,005	145	$1,006	.....	$2,200
Aug. 12	244	11,672	382	14,609	47	485	.....	2,700
Aug. 19	214	7,398	496	34,417	128	1,056	.....	2,163
Aug. 26	335	15,420	333	23,076	84	1,599	.....	4,767
Sept. 2	323	15,022	256	9,289	76	1,072	289	3,563
Sept. 9	282	13,640	273	12,187	45	261	.....	2,318
Sept. 16	397	19,615	313	16,543	...	.....	.....	2,401
Sept. 23	405	24,146	260	9,799	...	.....	.....	4,594
Sept. 30	366	21,297	286	17,713	...	.....	357	4,755
Oct. 7	455	23,127	128	10,009	...	.....	320	5,060
Oct. 14	393	23,737	196	11,943	...	.....	378	4,113
Oct. 21	400	21,392	184	15,562	...	.....	537	5,204
Oct. 28	361	19,403	295	17,998	112	1,773	525	3,881
Average per week	337	$17,582	295	$15,857	91	$1,034	417	$3,670
Calculated per month	1,348	70,328	1,180	$68,716	364	4,136	1,668	14,680
Average value per ton	.....	$52	.....	$53.80	...	$11.40	.....	$10

Work has been started upon the Gould & Curry croppings and in September the Geyer lease shipped 230 tons to the Silver City mills. Preparations have been made for the testing of the outcrops of the Sierra Nevada mine. In Silver City, leasers are active and shipments totaling from 1000 to 1500 tons per month are being sent to the custom plants. The cyanide plants of Silver City treat from 1500 to 2000 tons of tailings per month. East of Virginia City the Comstock-Phoenix, Cosmopolitan and Monte Cristo mines are active. In the Comstock-Phoenix an important orebody has been opened up. The annual report of this company (Apr. 11, 1911) showed that 1800 ft. of development work had been done and 1100 tons of ore assaying $25 per ton produced. During September and October, 13 cars of ore aggregating 600 tons of a value approximating $100 per ton were shipped to the smeltery.

Three mines are producing comparatively high-grade ore, the Ophir, the Mexican and the Comstock-Phoenix. The Ophir produced ores ranging in value: From $45 to $88 per ton on the 2100 level; from $19 to $30 per ton on the 2200 level; from $9 to $96 per ton on the 2400 level. The average value for the three months given in the table was $52 per ton. The Mexican produced ores ranging in value: From $30 to $168 per ton on the 2500 level; from $7 to $33 per ton on the 2400 level; from $5 to $106 per ton on the 2300 level. The average value for the three months given in the table was $53.80 per ton. The average value per ton of the ore produced from the Union Consolidated was $11.40; from the Crown Point $10 and from the Chollar croppings from $5 to $14 per ton. The Yellow Jacket dump rock runs from $2 to $2.50 per ton. In the mine reports all rock above $5 per ton is reported as ore. While the bulk of the tonnage reported is comparatively low-grade there is sufficient high-grade produced to bring

MILLS IN COMSTOCK DISTRICT

Plant	Crushing Equipment	Capacity, Tons per Day	Cyanide Sand Plant, Tons per Day	Cyanide Slime Plant	Concentrator
Butters Co	20 stamps, 4 tube mills	200	100	100	Wilfleys vanners
Mexican	10 stamps, 1 chilean mill 1 tube mill	100	...	100	.....
Kinkead	6 Kirkead mills	40	...	...	vanners
Yellow Jacket	20 Kinkead mills	200	....	...	vanners
Diedrich	15 stamps	40	40	...	Wilfleys
Mills at Silver City and Dayton:					
Phillip	10 stamps	30	30	...	.....
McTigue	15 stamps	40	...	...	vanners
Overland	10 stamps	30	...	...	.....
Nevada Reduction Works	18 stamps	50	...	...	.....
Nevada Reduction Works	40 stamps	160	...	...	vanners
Woodbury		...	30	...	.....
Donovan		...	30	...	.....

From the weekly reports the accompanying table has been compiled.

The calculated total per month is 4560 tons of a value of $157,860. From the lease on the Chollar and Potosi croppings about 5000 tons per month of a value in round numbers of $40,000 are being produced. From the Yellow Jacket dump 5000 tons of low-grade ore are being worked per month. From the Justice mine 750 tons are reported. The monthly production from the lode is approximately 15,000 tons of a value between $175,000 and $225,000.

the bullion production up to a good figure.

Underground Work and Equipment

In the Mexican mine many departures from the usual Comstock methods are to be noted. The more important are: The practice of filling and using lighter timbers in the stopes; the use of stulls in the raises where shrinkage stoping is to be practiced; the use of water Leyners for drifting and crosscutting, Waugh machines for stoping and plug-drills for cutting hitches; the use of the "squirt" for clearing drill holes in all headings; the timbering of raises and winzes with shaft timbers instead of square sets; the use of the skip and storage bins on winzes; direct-connected, motor-driven, high-efficiency fans; improved ventilating-pipe construction; the general use of telephones in the principal mine workings as well as at the stations and the use of electrical hoists for winzes. The successful attempts at this mine to better operating conditions, as well as the improved methods of prospecting and development, cannot be without important influence on the other mines of the lode.

In the Sutro tunnel the storage-battery locomotive has been discarded and mule tramming resorted to. The wooden water boxes have been replaced by wooden stave pipe. All of the working mines are provided with telephones at the principal stations and incandescent lighting is generally resorted to. Flash and bell signals are in general use in all the mines. Square setting is still a feature of the stoping practice and it is doubtful whether the conditions peculiar to the lode will admit of much modification except in the case of narrow orebodies. Machine drills are used in most of the mines and hand drilling is seldom seen. In heavy ground the use of easing sets in the shafts is common.

Surface Equipment

A general movement to comply with the provisions of the Nevada mining laws is taking place although the companies are not compelled to do so in all particulars. Cages have been provided with steel doors for use in hoisting and lowering men. Signal charts have been posted at all the shafts and underground stations. The wooden buildings surrounding the C. & C., Ward, Belcher and Yellow Jacket shafts have been torn down and the shafts are open to the weather. The only wooden shaft houses on the lode are the Overman, Ophir and Alta.

Three steam hoists are operated, the C. & C., Ward and the Overman. Steam hoists are held in reserve at the Ophir, Combination and Alta shafts for repair purposes but are only occasionally used. But two electrically operated hoists of the Risdon continuous-rope type are in operation (at the Union and Yellow Jacket shafts); the Belcher, the Golden Gate and the hoists on the winzes are all of the gear-driven drum type (motor driven). Change rooms, timber-framing and blacksmith shops are maintained at all of the working shafts. At the Union, Ward and C. & C. shafts the blacksmith shops are provided with drill-sharpening machines.

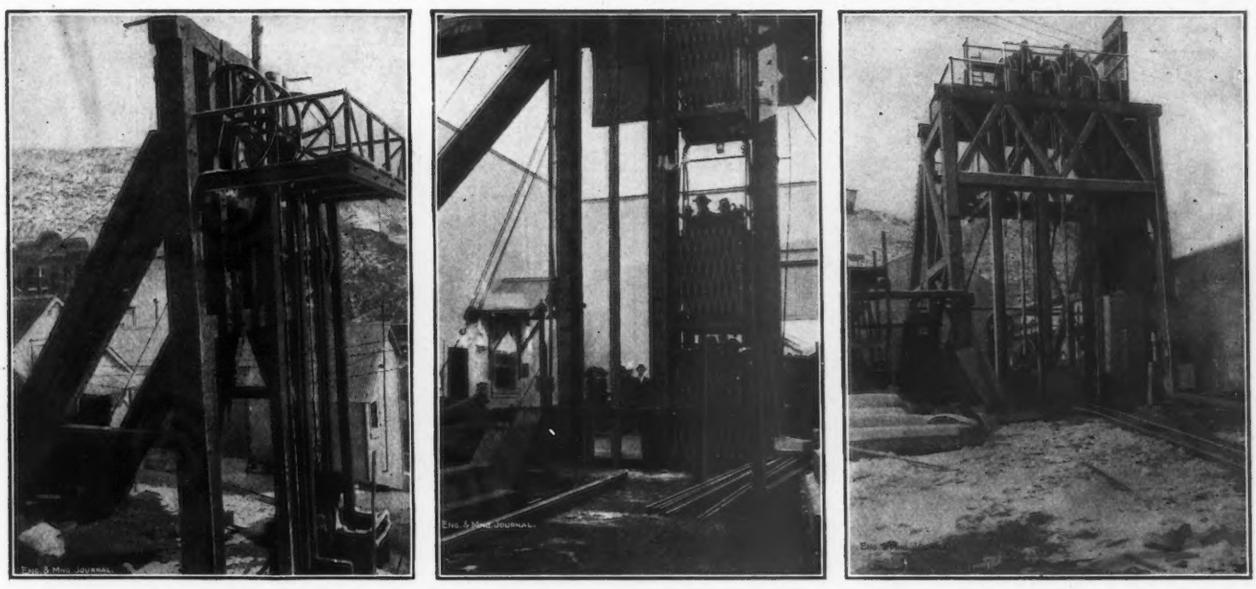
Two machine shops, one at the C. & C. and the other at the Ward serve for repair work. At the same shafts are rope houses for the repair of the flat ropes used in hoisting. Compressors, all of the two-stage type, belt driven by motor, are operated at the Union, C. & C., Ward and Yellow Jacket shafts. A multivane exhaust fan, operated by a 100-hp. motor, is in use at the Ophir shaft. The steel fan, formerly used at the Ward, has been discarded. Such electrical repairing as the rewinding of motors is done at the C. & C. and Ward shafts. The general upkeep and condition of both surface and underground equipment is excellent.

Low-grade Ore Milled Locally

High-grade ores are still shipped to the Selby Smelting & Lead Co., as well as to the Mountain Copper Co.'s plant at Martinez, but the greater part of the tonnage is treated in Virginia City at custom plants. The milling plants are given in the accompanying table.

The Mexican mill, now being erected, involves all of the best features in modern silver-gold mill construction. The all-sliming system without concentration is to be used. The Chas. Butters Co. is operating a mill which is equipped for all-sliming or slime-and-sand treatment with or without concentration. At present it is being operated on ore from the Chollar and Potosi croppings. The Butters and Mexican mills are the only mills which are equipped for the complete treatment of Virginia ores. The Kinkead and Yellow Jacket mills are concentrating mills and do excellent work on medium and low-grade ores. With other ores cyanide treatment is necessary in addition to concentration. Mr. Kinkead states that he secures 85 per cent. extraction from the Ophir second-class ore. With sliming and slime-treatment plants added to both of these mills, Virginia and Gold Hill would possess milling equipment for the treatment of 500 tons per day, a quantity sufficient to handle the present output.

The Mexican mill is on the terraced plan and is arranged for continuous treatment. After preliminary breaking the ore is crushed in a 10-stamp battery in cy-



Yellow Jacket, C. & C. and Ward Shafts on the Comstock Lode

anide solution; the pulp then passes to a chilean mill and from this mill to an Akins classifier where the sands are removed and discharged into a tube mill while the slime is sent to the first of a series of four agitating tanks. The tube-mill product is returned by bucket elevator to the classifier or may be sent to the agitating tanks. Trent agitators are used. From the agitating tanks the pulp goes to two Dorr slime thickeners and from these to an Oliver filter. A precipitating plant and refinery complete the equipment.

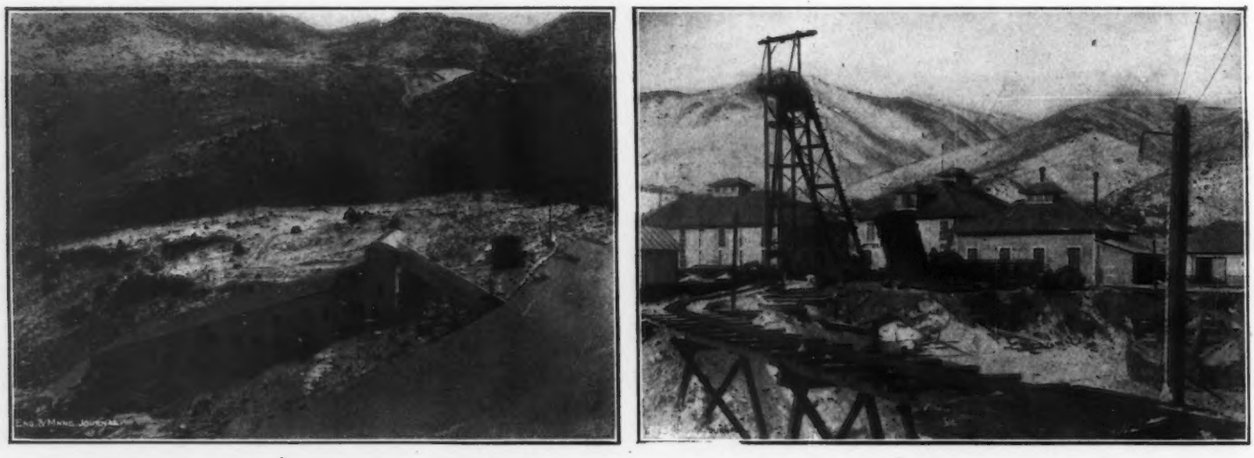
Mining Costs High

No clean-cut analysis of mining costs is possible under the present system of annual reports. The Con. Virginia and the Ophir publish annual reports and, while these give in many cases detailed information, the overlapping in time of the superintendent's and secretary's reports and the joint work done by several companies together preclude the determination of accurate unit costs. In the accompanying table I have summarized the disbursements of the Ophir Mining Co. as given in the last four annual reports. The cash-balance items and the dividend paid in 1908 have been omitted. The ore produced and the value are included in the table.

SUMMARY OF REPORTS OF OPHIR MINING CO.

	Year Ending			
	Dec. 18, 1907	Dec. 16, 1908	Dec. 15, 1909	Dec. 21, 1910
Labor	$70,060	126,355	124,548	117,378
General mine expense	46,006	37,340	36,696	38,444
Timber	5,971	10,760	8,790	6,634
Surveying	1,147	730	630	150
Assaying and sampling	5,220	10,115	7,778	3,646
Taxes and insurance	5,080	3,666	1,962	1,648
Freight and treatment	14,275	52,874	95,083	40,959
Pumping	56,159	49,032	58,758	56,479
Power, electric	25,869	26,970	30,866	29,551
Sutro tunnel	15,710	15,901	31,554	8,999
Salaries	9,720	8,138	5,335	5,479
Office and general	2,560	2,476	1,972	2,356
Royalty on ore	9,624	17,244	17,149	10,093
Legal expense	5,494	2,535	610	628
All other expense	1,382	24,807	8,667	4,159
Total	274,277	388,943	430,398	326,601
Realized from ore	230,728	404,488*	413,831*	247,475
Tons produced	9,916	26,537	20,701	11,049
Realized per ton	23.26	15.20	20.00	22.40
Cost per ton	27.65	14.65	20.79	29.56

*Includes returns from treatment of tailings the tonnage of which is not included in the tonnage given.



The Mexican Mill under Construction and the Union Shaft on the Comstock

Taking the year 1910 as an example, the proportion of the total expense for labor is 35.6 per cent.; for maintenance of workings and pumping, 32 per cent.; general mine expense and timber, 13.8 per cent.; ore treatment, assaying and sampling, 13.6 per cent.; salaries, 1.6 per cent.; and remaining, 3.3 per cent. Maintenance of workings and pumping is the most important burden of expense but it cannot be accurately segregated. Approximately 80,000 ft. of workings must be maintained throughout the lode for drainage, ventilation and mining purposes and this with pumping constitutes the great financial drain upon all of the mines. Incidentally it should be said that when the accumulated water has been removed and the drainage workings brought to first-class condition (which is practically the condition at present) the cost for maintenance and pumping will be materially lower than it is at present. The Ophir summary also indicates a movement which is quite general, namely, to reduce expenses wherever possible. The old generous management is quickly passing.

From various sources I have gathered the following information: Stoping in the Crown Point mine on the 1400 level and using square sets is done for $1.25 to 1.50 per ton. In the Mexican mine, stoping veins are from 2 to 3 ft. in thickness. The Virginia mine expense for the ore delivered at the surface was $6.50 per ton. In the Ophir mine in working around old stopes $10 rock enabled the mine to break even. In the Mexican mine the labor cost for drifting has been reduced to $3.50 per ft. and rates as high as 100 ft. per week have been obtained. Two men on a shift have obtained a rate of 50 ft. per week. From the Con. Virginia annual report of 1910 the cost of driving the joint Con. Virginia and Ophir east crosscut 374 ft. is given as $7576.78 or $20.73 per ft. Per-foot costs as high as $60 have been reached in driving exceptionally hot drifts. These figures are of interest in that they indicate the wide range in conditions pertaining in different parts of the lode. Con. Virginia and Ophir are notably hot and drifting and stoping costs are high; Mexican is comparatively cool and costs show a considerable decrease; the Crown Point is worked on the 1400 level and is cool.

The present wage scale at Virginia City is: Miners, $4; blacksmiths $5; machinists, $5; engineers, $5; firemen, $5; pumpmen, $5; shaftmen, $4 to $4.50; cagers, $4; carpenters, $5; shift bosses, $5; foremen, $6; millmen, $3 to $4. The 8-hour day prevails. Electrical power costs $5 per hp.-month; timber, from $21 to $22 per M.; powder, 12½ to 16½c. per lb. The total number employed in the

mines of Virginia City and Gold Hill is estimated at 700 men.

Milling and Reduction Costs

Accurate information concerning ore-treatment charges is obtainable and from the Ophir annual reports the accompanying table has been compiled. The next to the last column shows what per cent. the gross value is of the assay value; the last column, the per cent. the net value is of the assay value.

The charges of the custom plants are as follows: Kinkead mill (crushing and concentration), $2.70 per ton; Chas. Butters Co. (crushing, concentration and cyaniding), ore $20 or less per ton, charge of $3.50 per ton; ore above $20 per ton, charge $4.50 per ton. First-class ore is shipped to the Selby Smelting works and to the Mountain Copper Co.'s plant at Martinez.

At the Yellow Jacket mill, operating on the Yellow Jacket dump and simply crushing and concentrating, the milling cost is $1 per ton; on Crown Point ore the cost is from $0.75 to $0.85 per ton.

TREATMENT CHARGES ON COMSTOCK ORES

Ore	Custom Plant	Assay Value	Per Ton: Gross Value	Per Ton: Treatment, Freight	Net Value	Per Cent. of Assay	
No. 1 (09)	Selby smeltery	$98.00	$93.53	$16.73	$76.92	95.4	78.50
No. 2 (09)	Kinkead mill	23.45	18.16	3.97	14.19	77.4	60.49
No. 2 (10)	Kinkead mill	28.21	22.72	3.41	19.31	83.9	68.38
No. 2 (09)	Chas. Butters Co	26.01	22.12	6.00	16.12	85.0	61.95
No. 2 (10)	Chas. Butters Co	23.74	20.53	5.40	15.13	86.5	67 73

The operations on the Yellow Jacket dump afford the best example of low working costs. The rock has a value of from $2 to $2.50 per ton. It is excavated from the dump and trammed by hand to the crusher and from the crusher bins to the mill bins at a cost of 25c. In the mill an extraction of 88 per cent. at a cost of $1 per ton is reported. A profit of from $0.50 to $0.95 per ton is made.

Conclusion

An engineer cannot but be impressed by the magnitude of the work required in the opening of these mines and the difficulties, natural and financial, which confront the managements. Commendable activity is to be noted in the search for ore and no possible chance for its discovery is being overlooked. Working costs are being closely scrutinized and economies and costs unknown to previous managements are being effected. Present workings, unless required for drainage, ventilation or mining, are being promptly abandoned and closed, thus increasing the effectiveness of the ventilation and decreasing the maintenance costs. Under the leadership of Superintendent Symmes an efficient engineering staff is being built up. Taking these facts into consideration the outlook for successful and profitable mining along the lode is excellent. In securing data for this paper I am indebted to Superintendent Symmes, of the Mexican mine; to Superintendent McCormick, of the Ophir, and to the *Virginia City Chronicle* for the weekly mine reports.

American Iron Ore Developments

By Bradley Stoughton*

During 1911, the development and production of the Texas ore fields progressed along the lines mapped out the previous year, and there were also important discoveries of new orebodies in the Lake Superior ranges. This was notably so in the case of the Vermillion range, where the first shipment of ore began in 1881, and from which about 30,000,000 tons of ore, mostly bessemer grade and of superior quality, have been produced. In 1911, shipments were made from new orebodies discovered in 1907—the first and only discoveries since 1881, except the one group found in 1888,—and these aroused renewed activity in exploration. The result was a number of small discoveries of promise and one deposit of high-grade ore, and apparently of large size east of Ely. In the Mesabi range, near Grand Rapids, strikes were made which indicate the possible existence of important new deposits; in the Marquette there were several discoveries and the Gogebic range disclosed a new producer east of the famous Newport mine and said to equal it in value and quality.

Much interest is aroused in the United States, both financially and otherwise, in iron mines in South America. It is known that abundant deposits exist in Brazil, and attempts were made recently to market them in the United States, but without success either as to purchase of the product or the mines themselves. A Brazilian attempt to finance a company for the manufacture of iron in that country was also unsuccessful, so far as known at present. It is stated, however, that an English-French company is working a deposit of magnetic ore in Brazil, said to be of high grade and as large as the Mesabi district. A United States company is contemplating expending several millions of dollars to open up the famous magnetic ore mine of Agalteca in Honduras and build a railroad to the coast, provided the report of their engineers indicates the presence of as large a deposit as is believed to be there. This "iron mountain" has been worked spasmodically, first by the Spaniards and later by the natives. American capital is also interested in the exploration of iron-ore indications of large extent in Mexico.

Iron manufacturers near the Atlantic seaboard, who are without large holdings in the Lake Superior region, took more interest in the available iron-ore supply of Europe, and some made visits abroad —especially to Sweden—to study this question. There is little doubt that a revival of activity in America would be followed shortly by a great increase in the importation of Swedish ores. Some of these rich ores can be sold to blast furnaces within about 100 miles of the Atlantic coast at a price which makes them more attractive than Lake Superior ores with the long-haulage charges added, or even than Eastern iron ores upon which a high freight rate per mile is demanded.

Most of the imported Swedish ores contain less than 0.35% phosphorus—generally much less,—and over 67% iron; the price is said to be 8c. per unit, c.i.f. Philadelphia, freight from the mine being above $2 per ton. The bulk of the imports were for one large eastern Pennsylvania steel company which contracted for 3,000,000 tons of ore during the next nine years, and for a combination of eastern Pennsylvania interests who also made a long-term contract, it is believed.

*Consulting mining engineer, 165 Broadway, New York.

Electric Production of Ferro-Tungsten

The Ampère Co., of Berlin, now smelts scheelite direct with sulphide of iron, with an addition of carbon in the electric furnace, according the the *Mining Journal*. The sulphide of iron serves as a flux. The product is a ferro-tungsten, containing but little carbonate, in the form of uniformly smelted regulus. The reaction in this process is $CaWO_4 + FeS + 4C = FeW + CaS + 4CO$. The silica contained in the scheelite is fluxed by the addition of lime forming a fluid and easily removable slag in which is contained the calcium sulphide formed according to the reaction hereinbefore given.

Proposed Mining Legislation

WASHINGTON CORRESPONDENCE

Representative Raber has introduced in Congress a bill to establish a mining-experiment station at Auburn, Placer County, Calif., to aid in the development of the mineral resources of the United States and for other purposes. The proposed station would be under the supervision of the Bureau of Mines and would be officered by an expert geologist and metallurgist at a salary of $4000 and a competent chemist at a salary of $2500. Not over $25,000 is to be expended in establishing, equipping and maintaining the station.

The work of the station is to analyze or assay rocks or mineral-bearing substances sent to it and to furnish, at a nominal charge, a complete statement of the results to the one sending the same. A further function is to carry on experiments with a view to developing and perfecting metallurgical processes.

Senator W. E. Borah, of Idaho, has offered a bill to provide for the acquiring of title to public lands classified as, and carrying, phosphate deposits. The bill requires that any person who has located, under the nonmineral-land laws of the United States, any lands which are subsequently classified as being valuable for phosphate may receive a patent therefor, which shall contain a reservation to the United States of all phosphate deposits in these lands and the right to prospect for, mine, and remove the same. All unappropriated public lands now embraced within first-form phosphate withdrawals shall be subject to location under the provisions of the agricultural public-land laws, subject to the provisions of this Act.

The phosphate deposits in these lands shall be subject to disposal by the United States in accordance with the provisions of the mining laws applicable to the acquisition of phosphate lands in force at the time of such disposal. No person shall, however, enter upon these lands to prospect or mine the phosphate without previous consent of the owner, except upon such conditions as to secure the payment of all damages to the owner caused thereby.

Coarse Battery Crushing at South Crofty, Cornwall

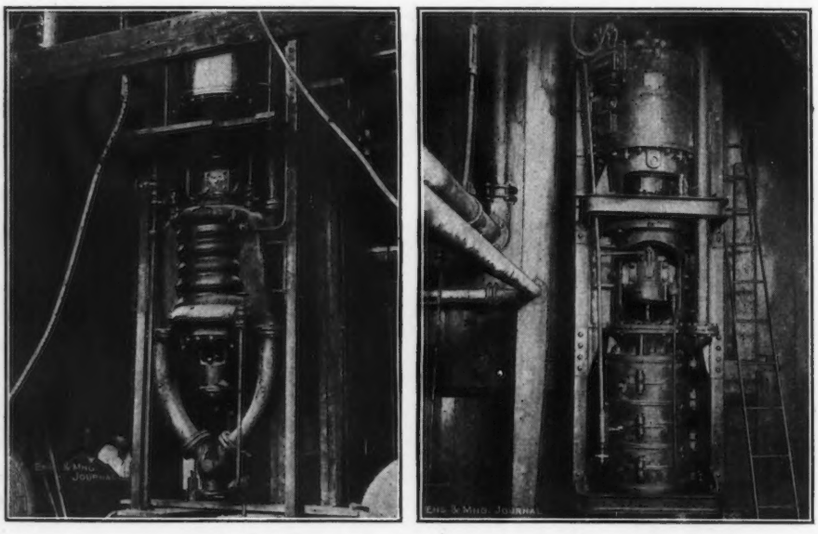
LONDON CORRESPONDENCE

After experimenting for six months on coarse crushing through a 10-mesh screen with 10 stamps, the South Crofty Co., in Cornwall, has adopted the coarse screen for the 60-stamp mill. It is expected that the change will be attended by an increase in the crushing capacity and in the recovery of tin and tungsten. Previous to the change the recovery was close to 30 lb. per ton. The value of the present production is about £41,300 per month; the profit was £150,000 for last year.

German Electric Mine Pumps

BY ROBERT GRIMSHAW*

In Europe the use of electrically driven centrifugal pumps with vertical shaft, and the motor above the pump, in deep mines, is growing rapidly. This is chiefly by reason of the cheap and convenient application of power, low repair costs due to the absence of steam pipes; lack of ensuing rise of temperature in shafts and galleries; high duty; absence of shock, with its accompanying noise and wear and tear; cheap necessary attendance; small space required; and comparatively light weight. Not only this, but this type of pumps can cope with unfavorable conditions of dirty water, etc., which would be almost impossible to overcome with the ordinary horizontal reciprocating, steam-driven pump.



ELECTRIC MINE PUMPS IN GERMANY

The accompanying illustrations show such pumps built by the Siemens-Schuckert works. The motor is of the rotary-current type with short-circuit armature, and in order to be free from difficulties by reason of the wetness of the surrounding chamber, is fully water-tight encased. To prevent heating of the motor, it is water jacketed; the water for this purpose being taken from the "first pressure step" of the pump.

In order that all parts of the casing may be equally cooled, the water jacket is divided by partitions into several compartments. By means of a fan built in with the entire machine, the air in the interior of the motor is kept in circulation so as to cool off any parts where heat is developed, and yield to the shell the heat thus obtained.

To prevent obstruction in the cooling jacket, a filter is constructed in its supply pipe. The small amounts of impurity which, despite this filtering process, might collect in the jacket, are blown off from time to time through blowoff cocks. Where strong lyes are to be pumped, which cannot be used as circulation water for the motor jacket, a suitable special water supply is provided.

The motor journals are constructed with especial care. The upper one, which receives the weight of the rotor, is calculated to withstand side and end thrusts; the under one being for lateral thrust only; both have automatic lubrication.

The three cables are protected by a gas pipe screwed into the motor case, making a water-tight connection. In order to measure the load on the motor, and the amount of water delivered, there is a current meter at the point of attachment of the cable; this latter being preferably near the regulating valve of the water pipe.

The motor is started from outside the mine by a transformer with suitable step switches; this part of the equipment being inclosed in a case covered with sheet metal. The current conductor which is a flexible rubber-covered cable with wire protection and no lead covering, can carry 3000 volts. A special line of conductors enables throwing out the motor from the neighborhood of the pump, in case of necessity.

As a rule, the cable is attached to the discharge water pipe, but it can hang free and carry its own weight; in the latter case being carried by a winding drum with compound countershaft, double gears and twin brakes. The smaller motors are built for 500 volts; the larger ones, in order to reduce the necessary cross-section and weights of the cable, for 3000 volts.

*Engineer, Dresden, Germany.

Manufacture of Sulphuric Acid

By Max Hasenclever*

Modern practice in sulphur-dioxide generation tends toward the use of larger mechanical roasters for pyrites; increased use of gases from the roasting of blende, galena and copper ores. The tower's theoretical advantage over the chamber not demonstrated yet in practice.

*Chemical manufacturer, Chemische Fabrik Rhenania, Aachen, Germany.

Note—Excerpts from the Hunter Memorial Lecture, Liverpool University, Oct. 25, 1911.

In regard to the future of the sulphuric acid industry, the mechanical furnace will no doubt be preferred to the hand furnace for the roasting of pyrites, when new plants are erected. Recently the Wedge furnace, developed and thoroughly tried during long years of practice in the United States, has been successfully introduced in Europe. In Germany this furnace is already working satisfactorily in five of the best known chemical works, and another 15 of the furnaces are in course of construction. The work done by the largest type is six or seven times as large as that of the well known Herreshoff furnace, and amounts to about 20 tons of pyrites per 24 hours. The main feature of the Wedge furnace is that it permits of repairs being made without interruption of its working. There seems to be no particular economy in cost of construction or in working expenses. Its design, however, is much more compact and simpler than that of seven Herreshoff furnaces. For the chlorination roasting of burnt ore the mechanical furnace of Ramen Beskow of Helsingborg is being widely adopted. By utilizing the sulphur contained in the burnt pyrites for heating, it secures a considerable saving of fuel.

Utilization of Blende for Sulphur

There is slow progress in mechanical furnaces for roasting blende. Many zinc works in Germany have spent large sums of money on experimental furnaces of their own construction. I do not see, however, why Matthiessen & Hegeler's furnace, which has stood the test for many years in the United States, has not been more rapidly adopted in Europe, for it is always more expedient and cheaper to buy existing experience than to gather it at one's own expense. The main difficulty in introducing mechanical furnaces for blende in Germany seems to be the fact that most of the zinc works are obliged to buy their ore without being able, in every instance, to select the quality according to their requirements. The result is that generally part of the ores received contains more or less lead and sinters when roasted. Such ores deposit on the hearth of the furnace and stick to the rods and moving parts, causing stoppages which make economical working difficult.

Improvements in the roasting of lead ores, which are now being utilized for the manufacture of sulphuric acid, also deserve notice. The lead ores treated in Europe carry 11 to 15% of sulphur, the greater part of which is contained as lead sulphide. By the old roasting methods, the burner gases contained 0.8 to 1.0% of sulphur dioxide. The converter gases of the well known Huntington-Heberlein process, by which air is blown through a layer of lead ore one meter thick, yield up to 15% of sulphur dioxide during the stage of their most active development, while at the beginning and the end of the roasting, gases poor in sulphur dioxide are produced. The result is that a fairly continuous gas current can only be obtained by working a large number of converters charged at different times, the production of sulphurous acid being in a different stage in each of the converters. Manufacture of sulphuric acid in connection with the Huntington-Heberlein process was first introduced at the Muldenhütte in Freiberg, Winkler's contact process being used. The same roasting method is in operation at the Royal Friedrichshütte near Tarnowitz in Silesia, the roaster gases being treated by the chamber process.

Dwight-Lloyd Roaster Gives Uniform Product

As compared with the Huntington-Heberlein converters, the working of which is intermittent, the Dwight-Lloyd furnace, improved by Schlippenbach, works continuously. By this apparatus the air is not blown through the material from underneath, but sucked down from the top to the bottom. The advantage of this furnace consists in delivering a regular gas current of 4 to 6% of sulphur dioxide by separating continuously the rich from the poor gases and, in all probability, about 90% of the sulphur, contained as sulphide in the lead ore, can be utilized for the manufacture of sulphuric acid; that is to say, 4 tons of lead ore will yield one ton of sulphuric acid of 60° Bé. A large plant for the manufacture of sulphuric acid by the contact process combined with furnaces of this design is in course of erection at Stolberg and will be started in a few months. There will certainly be difficulties to overcome at the beginning, as the gases contain 5 to 6% by volume of carbon dioxide and much dust.

If all the lead ores smelted in Germany were to be treated in this way, they would yield about 40,000 tons of sulphuric acid of 60° Bé per year. In England the production would only be about 6000 tons, in Belgium 18,000 tons, in France 12,000 tons, in Spain 75,000 tons.

Yield of Acid from Chambers

It has no doubt been easily possible everywhere to improve the yield of the lead-chamber space by increasing the production. It seems however, to be advisable not to go too far in this respect and to be satisfied with a production of 5 to 6 kg. of sulphuric acid of 60° Bé per cu.m of chamber space per 24 hours, or, expressed in the English units, about 11 cu.ft. per lb. of sulphur burnt per 24 hours, as some works have had the unpleasant experience that with increased production, the cost of chamber repairs rose enormously. As regards large yields in as little space as possible, the tower processes of Opl of Hruschau and of the Griesheim-Elektron certainly deserve notice. Opl's process, with its eight towers in series, works in a similar way to the chamber process; towers one and eight—the first and the last—act together, that is to say, the nitrous vitriol flowing from tower No. 8 is run down tower No. 1, where it is denitrated. In the same way tower No. 2 works with tower No. 7, No. 3 with No. 6, and No. 4 with No. 5, the acids being raised on to the towers by the direct action of compressed burner gases, an operation which is protected by patent.

The Griesheim process differs from Opl's process inasmuch as, instead of nitrous vitriol, nitric acid is used, which has to be completely regenerated after the formation of sulphuric acid. Neither tower process, particularly the Griesheim one, has yet reached such a stage of development as to allow a definite opinion to be formed upon it. This, however, can soon be done as plants designed from the results of experience gained with provisional arrangements, are in course of construction. The tower process will no doubt have the advantage over the chamber process of saving space, and the cost of its construction will also be lower than that of chambers. It remains to be seen, however, whether the saving ef-

fected by smaller capital charges will not be counterbalanced by increased working expenses and repairs. Its working certainly requires careful supervision, as the consumption of nitric acid easily becomes heavy. In addition, the acid, through being continuously in contact with the packing material of the towers, will probably become more impure, even if the burner gases are subjected to a preliminary purification.

Chamber Process Costs

I believe that it will be difficult to effect further savings in the manufacture of sulphuric acid by the chamber process. On the other hand, the cost of sulphuric acid is, in my opinion, often underestimated by engineering firms who devote themselves to the construction of sulphuric-acid plants. On the basis of figures at my disposal, I have made up the following cost sheet:—

MANUFACTURING COSTS OF 100 KG. OF SULPHURIC ACID 60° BE

	Marks.	
Roasting of pyrites		
Available sulphur in pyrites ..	1.00	
Crushing and roasting	0.25	
Depreciation	0.14	
		1.39
Manufacture of sulphuric acid:		
Working of chambers including repairs	0.46	
Concentration	0.15	
Depreciation: Chambers. 0.25		
Accessory plant 0.05		
	0.30	
		0.91
		2.30
Average carriage expenses in Rheinland		0.30
Tank cars		0.10
Cost, delivered free, consumers' works		2.70
4% interest on capital invested		0.20
		2.90
		67.8c.

In the manufacturing costs of sulphuric acid, the prices of the raw material play the most important part, and the amount of the first item in my cost sheet, "Available sulphur in pyrites 1 m. per 100 kg." will probably have to be modified. (1), if the works is in a position to burn pyrites from its own mines instead of having to buy it at the market price; (2) if pyrites containing copper is treated and the yield of copper credited to sulphuric-acid account; or (3) if sulphide of iron from gas works can be had at a low price, or (4) if it is possible to buy the burner gases from zinc works on favorable terms.

Use of Blende Usually not Economical

It is a mistake, still occasionally made, to believe it cheaper to make sulphuric acid from blende than from pyrites, on the assumption that the sulphur contained in the blende is not paid for. Even old hands who ventured on roasting zinc blende have been greatly disappointed. With the high wages and prices of fuel ruling today, the charges for roasting blende by hand amount to at least 1.50 m., per 100 kg. of sulphuric acid of 60° Bé. It must besides be remembered that losses of zinc and inefficient roasting may materially increase the costs. The zinc works making sulphuric acid do not debit the total roasting expense to the sulphuric-acid account, but only that part of the charge which exceeds those incurred by the former method of roasting in the reverberatory furnace, without any production of sulphuric acid. The balance of the charge is debited to the zinc account. Owing to this way of reckoning, which, in reality, is not correct, because the zinc works are no longer permitted by European law to roast their ores without making sulphuric acid, these works are frequently willing to sell their acid at low prices.

Altogether the charges for roasting blende are higher than those for pyrites, crushing, roasting, and depreciation taken together. The latter, which amount to 1.39 m in my calculation, rae the same both with the tower and the chamber process; it therefore remains to be ascertained what the clear manufacturing costs of sulphuric acid, including amortization, will amount to by the tower process.

I still have to mention that with the plant considered in my calculation only about 10% of the total acid is concentrated in the Glover, the remainder having to be evaporated in special concentrating apparatus. A saving in the concentrating charges will be effected if a greater quantity of Glover acid can be sold.

For depreciation of the plant, I have taken a rate of 8%, which leads to about scrap value in 10 years. Interest at a rate of 4%, which, I think, should also be taken into consideration, increases the cost by another 0.30 m. per 100 kg. of sulphuric acid of 60° Bé. Finally I must point out that the value of the land has not been taken into account, and that construction and working expenses will be materially increased by railway sidings, laboratory, offices, etc., in case an entirely new factory has to be built instead of additional plant in works already existing.

The purification of the burner gases from arsenic and dust is today easy and only a question of additional cost in plant. There is nothing new to say regarding the contact processes, only it is interesting to note that well known factories working the contact process, have also adopted to a large extent Gaillard towers for concentrating chamber acid.

European Acid Consumption

The consumption of sulphuric acid is constantly increasing with the steady development of the superphosphate industry. In 1910 the production of superphosphate was: England, 1,000,000 tons; Germany, 1,400,000 tons; France, 1,600,000 tons. An equal quantity of sulphuric acid of 60° Bé is necessary for this production. During the last few years the acid consumption has experienced an enormous increase owing to the increasing number of coke ovens which manufacture byproducts. On the other hand, the selling prices of sulphuric acid have been unfavorable, considering the high prices of pyrites, fuel and wages. Manufacturers of sulphuric acid in the industrial district of Rheinland and Westphalia experience great difficulty in dealing with a syndicate of the ammonia makers from coke ovens, who, in view of their large consumption of sulphuric acid which amounts to 300,000 tons, threaten to start their own manufacture of acid and try by every means to depress the prices. Against these proceedings a combination of sulphuric acid makers is powerless.

There is at present a great scarcity of sulphuric acid in this district, and because at the low prices ruling, no one feels inclined to invest further capital in sulphuric acid plant. It is all very well for the coke ovens to make enormous profits on the byproducts, but they should not grudge other industries the smallest profit. Then there would certainly be enough acid at their disposal. It is particularly striking that the acid works are obliged to buy their coal and coke at high prices, prescribed by the syndicates established by the same mines, who consume their sulphuric acid. By these remarks I intended to show the disadvantages of being dependent on syndicates or large consumers. As far as I know, the situation in England in this respect is much better than in Germany.

Division of Standard Oil Trade

The Standard Oil Co., of New Jersey, because of the Supreme Court decision, has given over its business in the Pittsburgh district to four corporations, which began operations on Dec. 23, as follows:

The South Penn Oil Co., Joseph Seep, president, assumes the leadership. This company is the chief producer in Pennsylvania and Ohio.

The second company is the Washington Oil Co., a smaller producing concern operating in the field with drillers and prospectors.

The third is the Crescent Pipe Line Co., formerly a subsidiary of the National Transit Co., which operates the trunk line for oil pipes in the Pittsburgh field, transporting oil to the refineries.

The fourth concern is the Eureka Pipe Line Co., which is what oil men call the "gathering system."

The Flameless Combustion of Gas

By William A. Bone*

If an explosive mixture of air and gas be caused to burn on an incandescent porous surface, high temperatures can be obtained with no flame and with a high degree of efficiency.

If an explosive gaseous mixture is either injected on or forced through the interstices of a porous refractory incandescent solid under certain conditions, a greatly accelerated combustion takes place within the interstices or pores, or in other words, within the boundary layers between the gaseous and solid phases wherever these may be in contact, and the heat developed by this intensified combustion maintains the surface in a state of incandescence without any development of flame. Such conditions realize my conception of flameless incandescent surface combustion as a means of greatly increasing the general efficiency of industrial heating operations wherever it can be conveniently applied.

Note:—Excerpts from a lecture delivered before the American Gas Institute at St. Louis, Oct. 19, 1911 and copyrighted by the Institute. Published by permission.

*Professor, fuel and metallurgical departments, University of Leeds, England

Advantages of the Process

The more important features of the processes of incandescent-surface combustion were evolved at the works of Wilson & Mathiesons, Ltd., Leeds, where an experimental station has been built. out the aid of elaborate regenerative devices, and owing to the large amount of radiant energy developed, transmission of heat from the seat of combustion to the object to be heated is rapid. These advantages are, I believe, so uniquely combined in the new system gether into a coherent block by suitable means; the porosity of the diaphragm is graded to suit the particular kind of gas for which it is to be used, but for undiluted coal gas, or coal gas containing only a small proportion of water gas, a diaphragm so porous that the gaseous mixture will readily flow through it at a pressure of ⅛ in. water gage is employed.

The diaphragm is mounted in a suitable casing, the space enclosed between the back of the casing and the diaphragm constituting a convenient feeding chamber for the gaseous mixture which is introduced at the back. Such a mixture may be obtained in either of two ways; by means of suitable connections through a Y-piece with separate supplies of low pressure gas and air (2 or 3 in. water gage only is sufficient), or by means of an injector arrangement connected with a supply of gas at 2 lb. per sq.in. pressure, the gas in this case draws in its own air from the atmosphere in sufficient quantity for complete combustion, the proportions of gas and air being easily regulated by a simple controlling device.

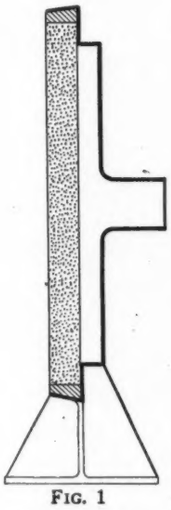


Fig. 1

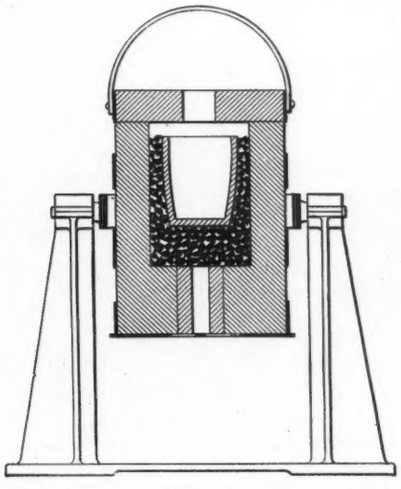


Fig. 2

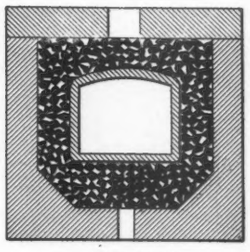


Fig. 3

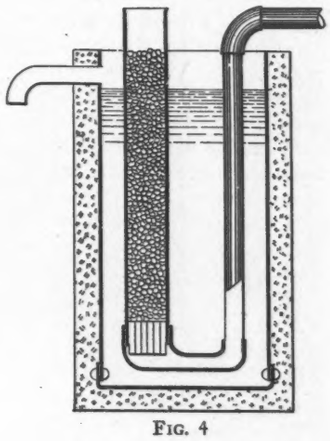


Fig. 4

The Engineering & Mining Journal

Diaphragm of Refractory Material, Crucible and Muffle Furnaces and Tube for Lead Melting Arranged for Flameless Combustion

The distinguishing and essential feature of the new processes is that a homogeneous explosive mixture of gas and air, in the proper proportions for complete combustion, or with air in slight excess, is caused to burn without flame in contact with a granular incandescent solid, whereby a large proportion of the potential energy of the gas is immediately converted into radiant form. The advantages claimed are: The combustion is greatly accelerated by the incandescent surface, and if so desired, may be concentrated just where the heat is required; the combustion is perfect with a minimum excess of air; the attainment of very high temperatures is possible with- that the resultant heating effect is for many important purposes, not only preeminently economical but also easy of control.

Gas Burns on an Incandescent Diaphragm

In the first process the homogeneous mixture of gas and air is allowed to flow under slight pressure through a porous diaphragm of refractory material from a suitable feeding chamber as indicated in Fig. 1, and is caused to burn without flame at the surface of exit which is thereby maintained in a state of red-hot incandescence. The diaphragm is composed of granules of firebrick bound to-

To start a diaphragm, gas is first of all turned on and ignited as it issues at the surface; air is then gradually added until a fully aerated mixture is obtained. The flame soon becomes non-luminous and diminishes in size; then a moment later, it retreats to the surface of the diaphragm which at once assumes a bluish appearance; soon, however, the granules at the surface attain an incipient red heat, producing a curious mottled effect; finally, the whole of the surface layer of granules becomes red-

hot, and an accelerated "surface combustion" comes into play. All signs of flame disappear, and there remains an intensely glowing surface, a veritable wall of fire but without flame throwing out a radiant heat which can be readily maintained for as long as required.

The actual combustion is confined within a thin layer (⅛ in. to ¼ in. only) immediately below the surface, and no heat is developed in any other part of the apparatus. While the front of the diaphragm is intensely hot, the back of the apparatus is so cold that a person may lay their hand on it. In the second place, the combustion of the gas, although confined within such narrow limits, is perfect, for when once the relative proportions of gas and air have been properly adjusted no trace of unburnt gas ever escapes from the surface.

Temperature Range is Great

The temperature at the surface of the diaphragm can be instantly varied at at will by altering the rate of feeding of the gaseous mixture; there is no lag in the temperature response, a circumstance of great importance in operations where a fine regulation of heat is required. The temperature of a diaphragm working on a coal-gas and air mixture, at a given rate of feeding, depends on whether or not the intense radiation from its surface is impeded; with a freely radiating surface the temperature of a properly made diaphragm may be maintained at anything up to about 850° C. (say 1550° F.) according to the rate of supply of the combustible mixture.

A plane diaphragm such as this may be used in any position, that is, at any desired angle between the horizontal and vertical planes. The diaphragm method is amendable to a variety of combustible gases. Coal or coke-oven gas (either undiluted or admixed with water gas), natural gas, petrol-air gas, carburetted water gas are all well suited in cases where unimpeded radiation is required. We have constructed and successfully operated plane diaphragms of all sizes up to 4 sq. ft. in area (2 x 2 ft.) and their durability and radiant power are unimpaired even after long continued use. The surface will maintain its incandescence unimpaired even in an atmosphere of carbon dioxide.

Advantage in Evaporating Liquids

The many obvious purposes to which diaphragm heating may be applied need hardly be pointed out. Grilling, roasting, toasting are all at once suggested. It will suffice to demonstrate the charm of novelty in the evaporation and concentration of liquids by means of radiant energy emitted from a diaphragm fixed in a horizontal plane above the surface of the liquid. By this means a solution of sodium silicate (water glass), can be evaporated, an operation it would be impossible to carry out satisfactorily by the ordinary means of heating the vessel by flame from below. Only the topmost layers of the liquid are heated; the radiant energy of the diaphragm is instantly transmitted to the surface of the liquid where it is absorbed and utilized for the evaporation. The sodium silicate separates out as a skin on the surface of the liquid, it is then dried by the radiant heat, and at intervals the crust of dry sodium silicate may be skimmed off. In this way, it is possible, not only to evaporate the solution with a great economy of heat, but also to complete the evaporation of highly concentrated solutions much more easily than by means of heat applied from below.

Applications to Crucible and Muffle Furnaces.

A second process consists esentially in injecting, through a suitable orifice at a speed greater than the velocity of back firing, an explosive mixture of gas (or vapor) and air in their combining proportions into a bed of incandescent granular refractory material which is disposed around or in proximity to the body to be heated. Two diagrams show its applications to the heating of crucible and muffle furnaces. The crucible (Fig. 2.) is surrounded by a bed of highly refractory granular material. The mixture of gas and air is injected at a high velocity through a narrow orifice in the base of the furnace, and as it impinges upon the incandescent bed combustion is instantaneously completed without flame.

The seat of this active surface combustion is in the lowest part of the bed; the burnt gases, rising through the upper layers, rapidly impart their heat to the bed maintaining it in a high degree of incandescence. A similar arrangement for heating a muffle furnace is shown in Fig. 3. The process is adaptable to the heating of retorts, annealing furnaces, and the like. Moreover, it is not essential that the bed of refractory material shall be disposed around the vessel or chamber to be heated; it may be equally well packed into tubes, or the like, traversing the substance or medium to be heated. This latter modification is important in relation to the melting of metals or alloys which are fusible at temperatures below about 1100° and also in relation to steam raising in multitubular boilers. By this process much higher temperatures are attainable with a given gas than by the ordinary methods of flame combustion without a regenerative system, and as a matter of fact, it has been found that with any gas of high calorific intensity, such as coal gas, water gas, or natural gas, the upper practicable temperature limit is determined by the refractoriness of the material composing the chamber to be heated *i. e.*, the muffle or crucible or rather than by the possibilities of the actual combustion itself. When I state that in a crucible fired by coal gas on this system we have melted Seger cone No. 39, which according to the latest determination of the Reichsanstahlt in Berlin, melts at 1880° C., and also that we can easily melt platinum, the possibilities of the method in regard to high temperatures with gas fired furnaces will be appreciated.

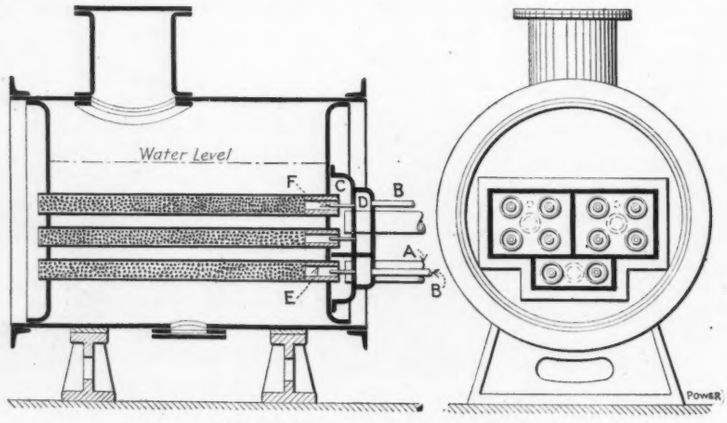


FIG. 5. EXPERIMENTAL BOILER

Material in the Diaphragms

For the very high temperatures obtainable with coal gas, water gas or natural gas, a bed composed either of fragments of magnesia, which has been burned a at high temperature or of a neutral and highly refractory material specially prepared is employed. In cases where the temperature required does not exceed 1200° C. (2200° F.) the bed of refractory material may be composed of good quality of firebrick crushed and screened to a suitable size. While with actual coal gas, water gas, or natural gas, it is possible to attain temperatures of up to at least 2000° C., with a producer gas of

low calorific intensity such as Mond gas, about 1500° C., would probably be the maximum temperature obtainable without regeneration. With some degree of heat recuperation, which in such a case would be quite practicable, in all probability this limit could be considerably exceeded.

RECORD OF MUFFLE TEMPERATURES

Temp. in Middle of Muffle, ° F.	Gas Consumption Cu. Ft. per Hr.	Temp. of Products, ° F.
1499	21.0	1004
1840	35.3	1195
2201	58.0	1598
2596	79.0	1985

Volume of gas used was measured at 59° F.

Record of Muffle Temperatures

In the accompanying table are shown the results of a test on a muffle furnace in which a muffle 9½ in. long by 5¼ in. wide by 3¼ in. high (inside dimensions) was heated to temperatures between 1500 and 2600°, with a fully aërated coal gas of 540 B.t.u. (net) per cu.ft. The temperatures given in the first column are those recorded by a standard thermo-junction placed in the middle of the muffle. The temperature of the escaping products was also ascertained by means of a standard thermo-junction. The temperature of the products in every case was 500 to 650° F.. lower than that of the muffle, and even with highest muffle temperature there was no appearance of flame whatever at the top of the furnace.

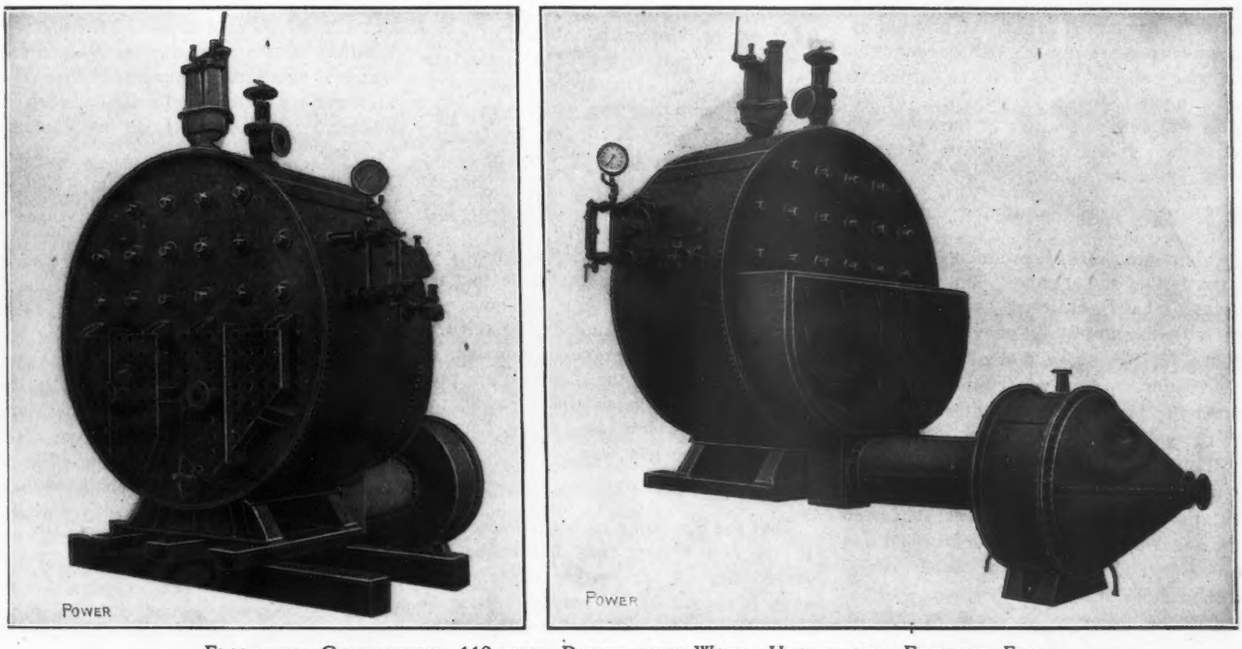
The gas consumptions recorded in the middle column are extremely economical in comparison with ordinary heating by flame contact. In a similar test with a muffle of the same size heated by flame contact in a furnace of modern design, the gas consumption to maintain the muffle at 1930° F., which was the maximum temperature obtainable, was 105 cu.ft. per hour, whereas by interpolation in the table the consumption in the "surface combustion" furnace at the same temperature would have been about 43 cu.ft. per hour only.

Application to Tubular Boilers

The gas firing of steam boilers has not been successful from the point of view either of thermal efficiency or of rate of evaporation. In this country there are a variety of gases available for steam raising purposes, for example; blast furnace gas, the surplus gas which is obtained in the manufacture of coke in byproduct ovens, natural gas, producer gas of various compositions, but more particularly that manufactured under "ammonia recovery" conditions. All these gases have been found amenable to the system.

It has been estimated by a prominent English blast-furnace engineer that the efficiency of the best type of water-tube boiler, fired by blast-furnace gas, does not exceed about 55%. From careful observations, which were made on a battery of Lancashire boilers fired by blast-furnace gas, evaporating water previously softened to less than four degrees of hardness, with an attachment of the most approved type of economizers (so that the temperature of the gases going to the chimney was reduced to the lowest possible point consistent with good draft) it was proved that the thermal efficiency does not under the best of conditions exceed 60%. With regard to boilers fired by coke-oven gas, I think one can safely say that the average thermal efficiency of steam-raising does not exceed 65% and in exceptional cases it may amount to perhaps 70%, not more.

On applying the principle of surface combustion to the gas-firing on multitubular boilers it has been possible to obtain results corresponding to the transmission of nearly 95% of the energy represented by the net calorific value of the gas to the water in the boiler. The boiler, cylindrical section, is traversed horizontally by a series of steel tubes, each three feet only in length and three inches internal diameter. These tubes are packed throughout their whole length with fragments of a suitable refractory material, of a proper size. Into the front end of the tube, where the gaseous mixture is introduced, is fitted a fire-clay plug, through which is bored a hole of about ¾ in. diameter. This plug serves a double purpose of keeping the front end of the boiler cool, and of providing a suitable aperture through which the gaseous mixture may be introduced at a speed very much higher than the speed of back-firing.



Flameless Combustion, 110-tube Boiler with Water Heater and Exhaust Fan

Combustion Confined to Interior of Boiler Tubes

Attached to the front plate of the boiler is a mixing chamber of special design. The mixture fed into the boiler tubes from this chamber consists of the combustible gas with a proportion of air slightly in excess of that required for complete combustion. The mixture is injected or drawn in (either by pressure or by suction), through the orifice in this fire-clay plug, to the incandescent material in the tubes. The combustion of

the mixture in contact with the incandescent material is completed before it has traversed a length of 6 inches from the point of entry to the tube. The result is that the core of the material at this part of the tube is maintained at a high temperature, although the points of actual contact between the hotter material and the walls of the tube are so rapidly cooled by the transmission of heat to the water in the boiler that they never attain a temperature even approaching red-heat.

The combustion having been completed, the remainder of the material acts as a baffle toward the burned gases as they traverse the tubes at a high velocity, causing them to impinge repeatedly on the walls of the tubes. The usual rate at which the gaseous mixture is fed into the boiler corresponds to an hourly consumption of about 100 cu.ft. of coal gas plus six times its volume of air for every tube of the boiler. In the case of a 10-tube boiler on which the original experiments were made, the consumption of coal gas was about 1000 cu.ft. per hr., plus about 5500 to 6000 cu.ft. of air. This will convey an idea of the extremely rapid rate at which the mixture is caused to traverse the tubes.

Hot Flue Gases Utilized

After the burned products have traversed the boiler-tubes, and at their point of exit therefrom, it is found that their temperature is never more than about 125° F. above that of the water in the boiler, which, of course, depends upon the pressure at which the steam is being generated. In order to increase still further the output of steam, the products are passed through a short tubular feed-water heater constructed on the same principle as the boiler. During a test carried out at the experimental station at Leeds, in which steam was being generated at a pressure of 100 lb. per sq.in. above that of the atmosphere, the temperature of the products leaving the boiler-tubes was 445° F.—the actual boiling point of the water being 337° F. These products, still containing a certain amount of valuable heat, were passed through the feed-water heater which was only one foot long, containing nine tubes of the same diameter as the tubes in the boiler. Each tube was packed with granular material. The hot products, continually baffled in their passage through the tubes, readily imparted their heat to the cold feed water surrounding them. We were thus able to reduce the temperature of the products leaving the feed-water heater to 203° F. We have worked entirely on Leeds coal gas. The temperature of the water entering the feed-water heater was 42° F., and it was heated to 136.4° F., before entering the boiler, entirely at the expense of the burned gases.

The mixture of gas and air was passed into the feed chamber of the boiler at a pressure of 17.3 in. water gage. This pressure is necessary to overcome the resistance of the packing of the tubes to the passage of the gases through them. The pressure of the products entering the tubes of the feed-water heater was 2 in. water gage so that the pressure necessary to force the gas through the zone of combustion, and thereafter through the remainder of the length of the tubes of the boiler was about 15 in. water gage.

High Efficiency in Heat Transmission

The amount of coal gas fed into the boiler expressed as dry gas under standard conditions of atmospheric pressure and at 32° F. was 996 cu.ft. per hr. The net calorific value of the gas was 562 B.t.u. per cu.ft., so that the total heat supplied to the boiler, in terms of the net calorific value of the gas, was 559,800 B.t.u. per hr. The actual amount of water evaporated from and at 212° would be 550 lb. per hr. The actual heat therefrom transmitted to the water was 450.3 $\times$ 1172 = 527,800 B.t.u. per hour. The ratio between the heat transmitted to the water and the net heat of combustion of the gas burned in the boiler, therefore was 0.943.

It is one of the outstanding merits of the new system that we are able to burn the gas completely with a minimum excess of free oxygen, and during the test in question the average proportion of carbon dioxide in the combustion products was as much as 10.6%, while the oxygen was as low as 1.6%. The remainder of the gas was nitrogen.

Boiler for Coke-Oven Gas

That the gas firing of boilers according to the new system has now been advanced beyond the merely experimental stage is proved by the recent erection of a 110-tube boiler capable of evaporating not less than 5500 lb. of water per hr., to the order of the Skinningrove Iron Co., Ltd. (the Cleveland District, Yorkshire), to be fired by gas from a new installation of Otto-Hilgenstock byproduct ovens adjacent to the blast furnaces.

The boiler itself is a cylindrical drum 10 ft. in diameter and only four feet from front to back; it is traversed by 110 tubes of three inches internal diameter which are packed with fragments of fire-brick. The boiler will be worked under the suction of a fan, capable of producing a suction of 20-in. water gage. To the front of the boiler is attached a device whereby gas at two inches water gage pressure from a suitable feeding chamber, together with a proper proportion of air from the outside atmosphere, is drawn (under the suction of the fan) through a short "mixing tube" into each of the 110 tubes of the boiler where it is burned without flame in contact with the incandescent granular material. The products of combustion, having traversed the four-foot length of packed tube, will pass outward into a semicircular chamber at the back of the boiler, and thence through a duct to the tubular feed water heater.

Under the normal working condition, the mean evaporation exceeds 20 lb. per sq.ft. of heating surface or about twice that of a locomotive boiler. Of the total evaporation no less than 70% occurs over the first part of the tubes, 22% over the next part and about 8% over the third part. Such a steep gradient causes a considerable natural circulation of the water in the boiler, a factor of great importance from the point of view of good working. In regard to thermal efficiency I venture to claim that a boiler unit which, while evaporating 20 lb. of water per sq.ft. of heating surface, transmits upwards of 90% of the net heat of combustion of the gas to the water, and which if need be, can be forced to a 50% higher duty with only a slight drop in efficiency, stands unrivaled as a steam raiser.

Heating Metals of Low Melting Points

I should like to refer briefly to the results of our experiments upon the fusion of metals; Fig. 3 represents an iron tank, efficiently lagged and filled to the top with molten lead at a temperature considerably above its melting point. In the molten bath is fixed an iron tube some two or three feet in length and of three inches internal diameter. This tube is packed, like one of the boiler tubes, with a suitable granular refractory material and there are suitable arrangements for the introduction of the explosive mixture of gas and air which is to be burned in the tube. When once the device has been started it will work continuously for days together. Solid lead is continuously fed into the apparatus and the molten metal is allowed to run over through the spout indicated in the diagram. Experiments have been carried out with tanks holding up to eight tons or more of molten metal in which a series of combustion tubes are fixed. By the means of such an apparatus, lead or other fusible metals or alloys may be melted not only rapidly but with extraordinary efficiency.

A correspondent reports that he experienced difficulty in determining the value of certain cyanide bullion due to discordant assays obtained. Upon analysis the bullion was found to contain cadmium. The zinc used in the mill is to be analyzed to determine whether this is the source of the cadmium.

Standard Specifications for Copper Wire Bars

A committee of the American Society for Testing Materials, affiliated with the International Association for Testing Materials, has presented a report on proposed standard specifications for copper wire bars, cakes, slabs, billets, ingots, and ingot bars, which reads as follows:

(1) All wire bars, cakes, slabs, and billets shall be stamped with the maker's brand and furnace-charge mark. Ingots and ingot bars shall have a brand stamped or cast in, but need have no furnace-charge mark.

(2) The refiner shall arrange carloads or lots so that as far as possible each shall contain pieces from but one furnace charge, in order to facilitate testing by the user.

(3) The copper in all shapes shall have a purity of at least 99.880% as determined by electrolytic assay, silver being counted as copper. All wire bars shall have a conductivity of at least 98.5% (annealed); all ingots and ingot bars shall have a conductivity of at least 97.5% (annealed), excepting only arsenical copper, which shall have a conductivity of not less than 90% (annealed). Cakes, slabs and billets shall come under the ingot classification, except when specified for electrical use at time of purchase, in which case wire-bar classification shall apply. The annealed copper standard, or resistance of a meter-gram of standard annealed copper at 20° C., shall be considered as 0.15302 international ohm. The per cent. conductivity for the purposes of this specification shall be calculated by dividing the resistivity of the annealed copper standard by the resistivity of the sample at 20° Centigrade.

(4) Wire bars, cakes, slabs and billets shall be substantially free from shrink holes, cold sets, pits, sloppy edges, concave tops and similar defects in set or casting. This clause shall not apply to ingots or ingot bars, in which case physical defects are of no consequence.

(5) Five per cent. variation in weight or ¼-in. variation in any dimension from the refiner's published list or purchaser's specified size shall be considered good delivery; provided, however, that wire bars may vary in length 1% from the listed or specified length, and cakes 3% from the listed or specified size in any dimension greater than 8 in. The weight of ingot and ingot-bar copper shall not exceed that specified by more than 10%, but otherwise its variation is not important.

(6) Claims must be made in writing within 30 days of receipt of copper at the customer's mill, and the results of the customer's tests shall accompany such claims. The refiner shall be given one week from date of receipt of complaint to investigate his records, and shall then either agree to replace the defective copper or send a representative to the mill. No claims will be considered unless made as above stated, and if the copper in question, unused, cannot be shown to the refiner's representative. Claims against quality will be considered as follows: (*a*) Conductivity by furnace charges, ingot lots, or ingot-bar lots. (*b*) Metal contents by furnace charges, ingot lots, or ingot-bar lots. (*c*) Physical defects by individual pieces. (*d*) Variation in weights or dimensions by individual pieces.

Investigation of Claims

(7) The refiner's representative shall inspect all pieces where physical defects or weight or dimension variation is claimed. If agreement is not reached, the question of fact shall be submitted to a mutually agreeable umpire, whose decision shall be final.

In a question of metal contents each party shall select a sample of two pieces. These shall be drilled in the presence of both parties, several holes approximately ½ in. in diameter being drilled completely through each piece, scale from set to be rejected. No lubricant shall be used and drilling shall not be forced sufficiently to cause oxidation of chips. The resulting samples shall be cut up, mixed and separated into three parts, each of which shall be placed in a sealed package, one for each party and one for the umpire if necessary. Each party shall make an analysis, and if the results do not establish or dismiss the claim to the satisfaction of both parties the third sample shall be submitted to a mutually agreeable umpire, who shall determine the question of fact, and whose determination shall be final.

In a question of conductivity each party shall select two samples, and in the presence of both parties these shall be rolled hot and drawn cold into wire of 0.08-in. diameter, which shall be annealed at approximately 500° C. Three samples shall be cut from each coil and the same procedure followed as described in the previous paragraph.

Settlement of Claims

(8) The expenses of the shipper's representative and of the umpire shall be paid by the loser, or divided in proportion to the concession made in case of compromise. In case of rejection being established, the damage shall be limited to payment of freight both ways by the refiner for substitution of an equivalent weight of copper meeting these specifications.

Explanatory Notes

These specifications are intended to allow for the fact that the refiner produces copper and gages its quality in furnace-charge lots, while the user purchases copper in carload lots, necessarily obtaining a different basis for sampling. It is intended to cover in these specifications an average grade of copper suitable for all mechanical uses and for making alloys to be used in various wrought forms. The specifications also recognize the fact that certain shapes are largely put to electrical uses where high electrical conductivity is important. They do not take into consideration the so called casting copper used for the purpose of alloying with other metals to produce cast shapes.

Plymouth Consolidated Mines, California

By Lewis H. Eddy*

The installation of the new electric hoist under construction for the Plymouth Consolidated mines, Amador County, Calif., should be completed by Feb. 1, 1912, when the mine will be unwatered preparatory to thorough exploration and development by the California Exploration Co., Ltd. The hoist will have a capacity for handling 300 tons per day from a depth of 2000 ft. The electric power will be obtained from the Western States Gas & Electric Co., of Stockton. An air compressor and other necessary equipment will also be installed. After the mine is unwatered the development will be proceeded with below the point where operations were terminated after the fire in 1888, which destroyed the timbering.

Mines Were Early Producers

The mines are among the early and large producers of the state, being successfully worked under various mine and company names since the initial location in 1852, until June 1, 1883, when the Empire and the Pacific companies were merged into the Plymouth Consolidated Gold Mining Co. Hayward and Hobart were then the principal owners, though much of the stock of the merger was held in New York. Litigation followed the fire, and in 1903 the superior court of Amador County quieted the title in the Hobart Estate Co., Alvinza Hayward and Charles D. Lane. Some work was done toward reopening, but without effort at ore extraction or milling; the property was finally closed down.

In April, 1911, Albert Burch, of San Francisco secured an option of purchase on the property, and this option was turned over to W. J. Loring, of Bewick, Moreing & Co. The latter organized the California Exploration Co., Ltd., to reopen the property and carry it through the preliminary stages. C. A. Moreing is chairman of the board of directors of the new corporation, and Mr. Burch is the representative of the board in Cal-

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ifornia. James F. Parks, of Plymouth, is superintendent at the mines.

The initial location of these mines was made by Hooper & Co., of San Francisco, and recorded as the Southerland and the Simpson & Aden claims; they were known and operated as the Phoenix mine. The property now includes also the Oaks, Indiana, Rees, Phoenix East and the Phoenix millsite; a total of six quartz lode claims on the Mother lode embracing a lode length of 4800 ft., and containing 64.40 acres; the strike is about north and south, the dip about 60° E. The millsite comprises about five acres. Included with the quartz mines are about 1400 acres of timber land. All the lands are held under U. S. patent, the title at the time of the option being in the Hayward Estate Co., Hobart Estate Co., and the C. D. Lane Co. The mines are situated in Sec. 11—T.7 N.—R.10E., M. D. M., in the northern part of Amador County, adjoining the town of Plymouth, and are at an elevation of 1050 ft. The total output from the beginning of operations in 1852 to the closing of the mines in 1888, a period of 36 years, was $6,953,000; total dividends of $3,301,000, were paid.

Two Inclined and One Vertical Shaft

At the time of the fire, in January, 1888, the mines had three working shafts as follows: The North and South Empire shafts about 200 ft. apart on the Simpson & Aden claim, and the Pacific shaft on the Oaks, about 1000 ft. southeast of the South Empire shaft. The North Empire shaft was 1200 ft. deep and the South Empire 1280 ft.; both were inclines, sunk on the vein, dipping east at 60°. The levels were opened 100 ft. apart, the lowest being at 1200 ft. in the South Empire. The Pacific shaft, vertical, was sunk to the east of the vein in the hangingwall for 1700 ft., intersecting the vein at about 1400 ft. Levels were opened and numbered from one to seven inclusive, at the following depths; 1060, 1140, 1220, 1300, 1400, 1500 and 1600 ft., another level being opened later at 940 ft., known as New No. 1. The vein was crosscut to the northwest on levels 1, 2, 3 and 4, level No. 1 being about 150 ft. long. In 1885 the Woolford shaft on the Rees claim was sunk 600 ft. east of the North Empire.

During the period of attempted reopening of the mines, in which three men were killed by the breaking of a hemp cable, the Empire and the Pacific shafts were partially unwatered and a bulkhead put in at 1350 ft. in the Pacific; a drift 1330 ft., and a crosscut 140 ft. long were run on level No. 2, encountering rich ore; an upraise of 200 ft., a new station at 940 ft., and a drift through the country rock to the top of the upraise, constituted the balance of the work done before the mine was shut down. This record describes the physical conditions of the property at the time of the passing of the option to Mr. Burch.

Stamp Mill Built in 1871

The earnest development and equipment of these mines were begun on the Phoenix mine in 1871 when a 40-stamp mill was installed on the Simpson & Aden claim; 20 stamps were added in July, 1876, and 20 more in October, 1876; a total of 80 stamps weighing 750 lb. each, with a crushing capacity of two tons per stamp per 24 hr. In June, 1876, the mill was treating 80 tons per day of $8 ore from the 900-ft. level, and the shaft was being deepened to 1000 ft. In April, 1877, the vein had widened to between 30 and 40 ft. of pay ore. There were then 145 men on the payroll. In September, 1878, the monthly output of bullion was reported at from $30,000 to $50,000, and the vein for a length of more than 400 ft. varied from 30 to 80 ft. in width. In November, 1878, a new shaft was started.

The Phoenix mine was sold to the Empire Mining Co., in the latter part of 1878, and then became known as the Empire mine. In March, 1879, the south shaft was 1250 ft. deep with the lowest level at 1200 ft., and in the following month the north shaft was 1200 ft. deep. The Pacific Mining Co. began development of the Oaks claim in May, 1880, sinking a 3-compartment, vertical shaft, 15 ft. in the clear, and the largest and finest hoist then in the state was installed. In August the shaft was 165 ft. deep; in October, 370 ft., and in October, 1881, 1000 ft. A new 40-stamp mill was installed at the Pacific mine and began dropping stamps in February, 1882; the stamps weighed 1000 lb. each, with a crushing capacity of two tons per stamp per 24 hr.; the fall of the stamps in this, as in the Empire mill, was 7 in., at 90 to 100 drops per min. The mill was driven by water power. The shaft reached 1400 ft. in 1882, and a 40-ft. vein said to yield $16 per ton, was intersected by a crosscut at that level.

Largest Producer in 1883

The United States Mint report for 1883 credited the Plymouth Consolidated, the merged Empire and Pacific, for that year with the production of more bullion than any other gold mine in the state, and with crushing about 250 tons of ore per day in the two mills. The 80-stamp mill received its water supply from the Cosumnes River, through a ditch which was also utilized for floating timbers for the mine; the 40-stamp mill received its water from the Amador ditch. The Empire mill was first steam-driven, but was changed to water power; the Pacific mill had steam power in reserve while water was the principal power. Forty-eight Frue concentrators and a chlorination plant were a part of the equipment.

The following summary is made from the United States Mint report for 1884, containing the last annual report of the Plymouth Consolidated: Gold bullion produced in 1884, $1,033,518; operating expense, $331,163; dividends, $600,000; surplus, including surplus on hand Jan. 1, $146,914. Less than one-half of the surplus was expended for mine betterment, development and permanent improvements; the total, including ditches, real estate, reservoirs, tunnel development, shaft construction, shops, machinery, etc., was $72,619, leaving cash on hand, $74,295. The two mills ran regularly, crushing an aggregate of 80,000 tons, yielding an average of $13 gold per ton. Deducting material on hand and outlay for reconstructing the Empire mill, etc., the cost of production was for mining, $3.20 per ton; milling, 48c. per ton; cost of saving and reducing sulphurets, 21c. per ton; total average cost of production, $3.89 per ton.

In 1886 the mines produced for the nine months ended in September, $447,547; operating expense for the same period was $193,145. On Oct. 5, the 41st consecutive dividend was paid, making a total of $1,775,000. The production in 1887 was $736,304; operating expenses, $297,404; dividends, $375,000; expended for construction, $46,861; surplus, Jan. 1, 1888, $98,118. The average cost of production in 1887 was $3.07 per ton. From the organization of the Plymouth Consolidated, in June, 1883, to January, 1888, the mines produced in gold bullion $3,804,499; operating expenses in that period, $1,442,074; construction, $217,626; and $2,200,000 dividends.

All Underground Workings Timbered

The following items are of interest. The entire underground workings were timbered, at a cost of $2 to $3 per log. Round pine was used and 7000 to 8000 logs per year were necessary, the cost of transportation being reduced to a minimum by floating the logs in the company's canals. The quantity of water raised in 24 hr. was 18,000 gal. Water for power was conveyed 2½ miles; the pressure head at the Empire and Woolford shafts was 550 ft. and 561 ft. at the Pacific shaft. Waterwheels required numbered 23, of which three were Leffel turbine, and 20 were hurdy-gurdy wheels. Ditches totaling 160 miles were built. The ore consisted of soft quartz and slate, and was free milling and concentrating. Percentage of sulphurets was 1.5; value of sulphurets per ton, $125 to $200; percentage of extraction, 92 to 95. The powder used was No. 2 safety nitro. The several months' duration of fire in these mines was due to the immense quantity of timbering necessary, and to the fact that the mines made so small a quantity of water.

New Publications

Preparazione Meccanica dei Minerali. 6½x9½, pp. 538, paper; 9.50 lire. Ulrico Hoepli, Milano, Italy.

The Granites of Connecticut. By Nelson Dale and Herbert E. Gregory. Pp. 137, illus. Bull. 484, U. S. Geological Survey, Washingon.

The Data of Geochemistry, Second Edition. By Frank Wigglesworth Clarke. Pp. 782. Bull. 491, U. S. Geological Survey, Washington, D. C.

The Forbes-Parkes Goldfield. By E. C. Andrews. Pp. 109, illustrated. Mineral Resources No. 13, New South Wales Department of Mines, Sydney.

Handbuch der Mineralchemie. By C. Doelter. Vol. I, parts 1, 2, 3 and 4. 7x10, pp. 640, paper; 26 marks. Theodor Steinkopff, Dresden, Germany.

Report on the Gypsum Deposits of the Maritime Provinces. By William F. Jennison. Pp. 182, illus. Canada Department of Mines, Mines Branch, Ottawa.

La Metallographie Appliquee aux Produits Siderurgiques. By Umberto Savoia. 5x7½, pp. 217, illustrated, paper. Gauthier-Villars, Paris, France.

Reinforced Concrete. Mechanics and Elementary Design. By John P. Brooks. 6½x9½, pp. 220, illustrated; $2. McGraw-Hill Book Company, New York.

The Geology and Ore Deposits of the West Pilbarra Goldfield. By H. P. Woodward. Pp. 142, illustrated. Bull. 41, Western Australia Geological Survey, Perth.

Geology and Ore Deposits Near Lake City, Colorado. By John Duer Irving and Howland Bancroft. Pp. 128, illus. Bull. 478, U. S. Geological Survey, Washington.

Geology and Mineral Resources of Parts of the Alaska Peninsula. By Wallace W. Atwood. Pp. 137, illustrated. Bull. 467, U. S. Geological Survey, Washington.

Official Year Book of the Commonwealth of Australia, No. 4, 1911. By G. H. Knibbs. Pp. 1230, illus. Commonwealth Bureau of Census and Statistics, Melbourne.

Sopra Alcuni Presunti Effetti Chimici della Pressione nel Metamorfismo Minerale. By Giorgio Spezia. 6½x9½, pp. 19, paper. Vincenzo Bona, Torino, Italy.

Quantity Surveying for the Use of Surveyors, Architects, Engineers and Builders, 5th Edition, Revised. By J. Leaning. 5½x9, pp. 936; $10. E. & F. N. Spon, Ltd., London.

Biennial Report on the Mineral Production of Virginia during the Calendar Years 1909 and 1910. By Thomas Leonard Watson. Pp. 123. Bull. No. VI, Virginia Geological Survey, Charlottesville.

Annual Report of the Division of Mineral Resources and Statistics on the Mineral Production of Canada During 1909. By John McLeish. Pp. 290. Canada Department of Mines, Ottawa.

The Clay and Shale Deposits of Nova Scotia and Portions of New Brunswick. By Heinrich Ries and Joseph Keele. Pp. 163, illustrated. Memoir No. 16-E, Canada Department of Mines, Ottawa.

Shape Book Containing Profiles, Tables, and Data Appertaining to the Shapes, Plates, Bars, Rails and Track Accessories. 5½x8, pp. 255, illus., leather. Carnegie Steel Company, Pittsburg, Penn.

The Diamond. By W. R. Cattelle. 5¾x8½, pp. 438, illus. $2. John Lane Company, New York.

The author of this book, after a commercial acquaintance of some years in the jewelry trade, decided to write, in a popular vein, a comprehensive digest of information extant about this precious stone. The work covers the mining, and the preparation of the diamond for the trade; aims as well to clear up popular misconceptions founded upon ancient traditions and misstatements.

Rocks in the Road to Fortune, or the Unsound Side of Mining. Second edition. By Henry B. Clifford. 6x8½, pp. 492, illustrated, half leather. Gotham Press, New York.

This book is written in the style its title indicates. Its aim is to point out to the inexperienced in the mining business the pitfalls of the wildcatter and wiles of the unscrupulous promoter. The author has a breezy way of expressing himself, and gives some excellent pointers which might save many a dollar, if the book could be placed in the hands of those who need it most.

The Mineral Industry of Rhodesia. By J. P. Johnson. 5½x8½. 90 pp. cloth. Longmans, Green & Co., London, Bombay and Calcutta.

This is a condensed account of the present condition of the mineral industry of Rhodesia, and is intended also to be a guide to some of its future possibilities. It contains also some accounts of the chief mines now in operation, and the more important mining districts. The geological treatment predominates throughout the book. A brief introduction on the general geology of Rhodesia is followed by successive chapters on Gold; the Small Mine Industry; Other Metals; the Tin Deposits of South Africa; Non-metalliferous Minerals; Diamonds and Coal. The book concludes with a chapter of hints to prospectors. The book has been bound with a number of blank pages interleaved, so that additional notes can be made in the appropriate place.

Rock Drilling With Particular Reference to Open Cut Excavation and Submarine Rock Removal. By Richard T. Dana and W. L. Saunders. 6¼x9¼, pp. 319, illus. $4. John Wiley & Sons, New York.

The object of this book is to place at the disposal of engineers who employ the rock drill "the fundamental facts for determining the best way of using the drill for any given conditions." To this end a great volume of data, from actual experience in many cases and under differing conditions, has been gathered, carefully summarized and worked into shape by the authors. It is not claimed that the work is complete, since much remains to be done in the way of collecting data, but it is believed that a large part of the available information on the subject has been covered. Surface and submarine drilling are covered in the present volume; an additional one on underground work would be equally valuable and interesting.

The Mining Industry of Mexico. Compiled and edited by F. Gonzales, A. Grothe and L. Salazar S. No. 1, State of Hidalgo, part I. 8x11½, pp. 73, paper. Vda. de Bouret, Avenida Cinco de Mayo, num. 45, Mexico, D. F.

This work is intended to supply the most reliable and uptodate information concerning Mexican mining and its probable future. Though not an official publication, it has been compiled at the instigation and with the assistance of the Department of Fomento by a large group of mining engineers who have carefully revised and edited the information contained in official documents and that obtained from private sources. This being the first work of its kind in Mexico, it must naturally contain some errors and show deficiencies, which though they may not be observed by the general reader will be apparent to those having a special knowledge of any of the various districts and mines considered. Such corrections as may be received by the compilers will be given a place in the supplement and in future issues. The book will appear in about 20 parts, including the supplement, which will contain additional data obtained during the publication of the work. The first volume comprises a valuable resumé of the mining industry, in the state of Hidalgo. The lack of a suitable index is an unfortunate omission.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

B. B. Thayer is in Butte, Mont., on a periodic tour of inspection.

George E. Collins passed through New York this week on his way to London.

Fred T. Williams has recently returned to Park City, Utah, from New York and Washington.

W. C. Russell has returned to the Rawley mine, at Bonanza, Colo., after a short trip to New York.

Frederick G. Clapp is investigating certain technical problems on the oil and gas industry in the Louisiana fields.

Charles Lindmueller is in charge of the new plant of the Goldschmidt Detinning Co., at East Chicago, Ind., where it will manufacture pig tin. The plant is nearing completion and will be operating in a short time.

Herman Frasch has been awarded the Perkin medal by the Society of Chemical Industry, the presentation to be made at Rumford Hall, New York, on the evening of Jan. 19, which will be devoted to a discussion of sulphur.

Chauncey Eldridge, representing Tucker, Anthony & Co., of New York, was in San Francisco recently in conference with Eugene de Sabla and John Barneson, who are together largely interested in the Midway and the Santa Maria oil fields.

George A. Guess has been appointed to the new professorship of metallurgy in the faculty of applied science and engineering of the University of Toronto. He is a graduate of Queen's University, and has had a wide practical experience in connection with large copper-mining concerns. He was for some time at the head of experimental and metallurgical work with the Cerro de Pasco Mining Co., of Peru.

The School of Mines and Metallurgy of the University of Missouri on Oct. 24, 1911, conferred upon William Rowland Cox the honorary degree of Engineer of Mines, the highest honor it could grant. Mr. Cox entered the school in 1893 and remained there during three years. Beginning in a humble position with a mining company, he rose through all of the important positions until seven years ago he was appointed manager for all of the Mexican mining properties of the Guggenheim interests. Several years later he became a member of the firm of Spurr & Cox, consulting engineers, and at present is at the head of "W. Rowland Cox and Staff."

Frank Griffin has succeeded Eugene de Sabla as president of the Natomas Consolidated of California, operating dredges at Natoma and Oroville. Mr. Griffin has been connected with gold dredging for a number of years and was influential in the consolidation of the several Natoma companies and others; he organized and operated the Western Engineering Co. which built some of the first gold dredges in the American River field; and introduced the Holmes gold-saving tables. Mr. Griffin as president of the Natomas will make no radical change in the policy of the company. Mr. de Sabla's retirement was due chiefly to the fact that the work was more than he could continue in addition to other mining enterprises in which he is engaged.

OBITUARY

Lyman Robinson died at Cañon City, Colo., Jan. 9, aged 78 years. He was born at Dubuque, Iowa, and went to Colorado in 1878, interesting himself there in mining enterprises.

Robert J. Hawke died at Denver, Colo., Jan. 5, aged 37 years. He was born in Nebraska and went to Colorado 18 years ago. He had been engaged ever since in mining and stock raising. He lived for a number of years at Idaho Springs, but recently removed to Denver.

David C. Kane, formerly of Salt Lake City, died at Callao, Peru., Jan. 1, according to advices just received. He went to Peru about a year ago in the employ of the Cerro de Pasco Mining Co. He leaves a widow with one child, born since his departure for Peru. No particulars of his death have been received.

Karl Krug died at San Francisco, Dec. 28, aged 38 years. He was manager of the Oro Water, Light & Power Co., dredging department at Oroville. His first practical work as a mining engineer after graduating from the University of California in 1899 was in Alaska. Returning he took the position at Oroville. He was born in California.

C. H. Palmer died at Atlantic City, N. J., Dec. 27. He was well known in Boston and in Butte, Mont. He was educated as a civil engineer, and later engaged in copper mining and in company management. He was president of the Butte & Boston Copper Mining Co. for several years, up to the time it was transferred to the Amalgamated.

Franklin Farrel, Sr., died at Ansonia, Conn., Jan. 10, aged 84 years. For many years he was one of the best known manufacturers in the Naugatuck Valley. He was president of the Farrel Foundry & Machine Co., whose business had been built up by him from small beginnings. He was also well known at Butte, Mont., where he was for a number of years head of the Parrot Copper Mining Co., until it was sold to the Amalgamated Co. He was much interested in improvements in metallurgy and the introduction of the Manhes converter in this country was due to him. He leaves a son and four daughters, one of whom is the wife of Charles F. Brooker, president of the American Brass Co.

George Brooke died at Birdsboro, Penn., Jan. 15, aged 93 years. With his brother, the late Edward Brooke, he established the iron industry in Birdsboro in 1837, and he was the oldest ironmaster in continuous service in Pennsylvania. Besides the making of iron the firm owned anthracite and bituminous coal mines, ore mines and wood lands in Pennsylvania and West Virginia. In 1845 the firm, which operated forges, built Hampton charcoal furnace. In 1858 their first anthracite blast furnace was constructed, and in 1870 and 1877 two others were added. In 1856 they erected the present nail works, and later added furnaces for making pipe and bar iron. They also started the plant of the Birdsboro Steel Foundry & Machine Co. The firm employed at Birdsboro about 3500 men. Mr. Brooke was a member of the Masonic fraternity, the Union League, Manufacturers' Club, Sons of the Revolution and Sons of the Colonial War. He was president of the Pennsylvania Trust Co., the First National Bank of Reading and director in the First National Bank of Birdsboro, and was reputed to be Berks County's wealthiest resident.

Societies and Technical Schools

Colorado Scientific Society—At the recent annual meeting in Denver, the following officers were elected for 1912: President, George E. Collins; vice-presidents, E. N. Hawkins, W. P. J. Dinsmoor; treasurer, John W. Richards; secretary, H. C. Parmelee; members of executive committee to serve three years, Prof. George L. Cannon, George G. Anderson.

Canadian Mining Institute—The fourteenth annual general meeting of the institute will be held in Ottawa, on Mar. 6, 7 and 8, 1912. The Institution of Mining and Metallurgy and the American Institute of Mining Engineers have accepted invitations to hold joint meetings with the institute on the above dates. The council hope to arrange for an excursion to Cobalt and Porcupine, to start from Toronto at the close of the meeting.

Mining and Metallurgical Society of America—The annual meeting was held at the Engineers Club, in New York, on Jan. 9, followed by the annual dinner in the evening. Both meetings were largely attended. The following officers have been elected for 1912: President, J. Parke Channing; vice-president, J. R. Finlay; secretary, W. R. Ingalls; councillors, James F. Kemp, H. S. Munroe, T. H. Leggett, H. M. Chance, F. Lynwood Garrison, Waldemar Lindgren, H. V. Winchell, Philip Argall, H. F. Bain, F. W. Bradley, S. W. Mudd and C. W. Goodale.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Jan. 10—Rain and snow accompanied by extreme cold in the closing week of December followed suddenly the period of dry weather in the northern half of the state that had caused some alarm in the mining districts regarding the probable water supply. There was in some fields fear of a water famine, though not well founded. The December precipitation was general throughout the northern counties, the rain extending as far south as San Francisco and the snow as far south as Oroville in the valley sections. The snow was general in the Mother lode and other elevated districts, and not unexpected; but at elevations of from 200 to 500 ft., as at Oroville, Chico, Red Bluff and Redding, snow is unusual, and was not expected. The South Yuba River at Washington in the northern part of Nevada County was frozen to a hardness that permitted skating, a condition not before known to obtain at that point. The freezing was due not wholly to extreme low temperature, but partially to the low stage of the water, resulting from the continued dry period. In some sections the power and water supply ditches were frozen, but as the companies keep men ready in such seasons to follow the ditch lines for the purpose of preventing disturbance of the flow, there was no actual danger of disastrous suspension of the supply for mining purposes.

The suddenness and severity of this storm following so closely the warning of the water companies that unless economy were practiced and wastefulness ceased there would be danger of freezing the reservoirs in the event of sudden fall in temperature, proved the wisdom of the warning. There are a number of mines dependent on water for power, and many of them are mines of importance that have installed costly machinery, and find it greater economy to continue the use of water for power than to discard the machinery and replace it with electrical power machinery. New installations, however, are almost wholly electrical, and the number of mines dependent on water for power is not increasing, on the contrary there is good reason to believe that when the mines at present operated by water-power plants shall require new power machinery, the waterwheels employed for direct power will be displaced by electrical plants. In some instances the demand for additional or increased power has been met by the installation of an entire new electrical plant and the retention of the water power as an auxiliary or supplemental power to be used in case of emergency. But the emergency of a deficiency of electricity is infrequent, and will continue less frequent as water power is discarded. While there is always a degree of uncertainty as to the water supply for power purposes in the dry seasons, there is no cause for fear that the supply will ever be inadequate for the generation of electricity, owing to the constant preparedness of the electric companies.

Denver

Jan. 11—As a result of the meeting held recently to agitate the question of securing an appropriation from the government to provide a metallurgical testing plant for the treatment of low-grade ores, R. Kenehan, president of the Colorado Mining & Metallurgical Association, will appoint a committee of five on legislation, which will coöperate with similar committees appointed by the American Mining Congress and the Denver Chamber of Commerce. If deemed necessary, it is possible that Colorado will send a delegation to Washington to lobby for the bill. All these organizations are making united and strenuous efforts to encourage prospecting and to induce renewed interest in mining throughout Colorado.

An important discovery of ore yielding 1½ oz. of gold per ton has been made in Stratton's Independence, under the office buildings, the gold having ordinary red granite for its matrix. A car per day is being produced from this strike. It is on record that Stratton made his first discovery at this mine, in red granite, on July 4, 1891, and shipped a car of it to the Boston & Colorado smelting works to the astonishment and amusement of the then general manager, when the car of granite rolled into the yard. He was more astonished when it sampled 3 oz. of gold per ton.

The latest report from the deep drainage tunnel, of Cripple Creek, is by Engineer Countryman, Jan. 3, in which it is stated that the total flow from the portal is 9060 gal. per min., and gradually increasing with every round of shots, though no strong watercourses are being cut; the formation is solid granite, but with iron pyrite in the joint planes, indicating the possible proximity of a mineral zone. The breast of the tunnel is 1420 ft. below the surface and headed in the direction of the Elkton shaft, which is in the breccia area. The total length from portal to breast is now 16,389 feet.

The Leadville district, like other Colorado camps, is taking on new life. The large operators seem to have decided that the bodies of ore which made the output from the upper and lower contacts, originally came from the fissures, such as are now being developed in the Cord winze, Tucson, Yak tunnel, Helena, and the Cleveland and other veins; that eventually the district will become a fissure-vein district. Prospects are good for the unwatering of the Fryer Hill mines, and, later on, the downtown mines. While the total tonnage of Leadville for the last year is less than for 1910, the value of the output for 1911 exceeds that of 1910 by nearly $2,000,000, the total for 1911 being $8,227,918. This is explained by the large increase in the output of carbonate-of-zinc ore, 69,340 tons more being mined in 1911 than in 1910. The production of gold also exceeded the previous year by 4000 oz. Owing to the large decrease in smelting operations through the state, there has been a diminished demand for the oxidized iron-silver ore formerly so much in demand as a flux. The total output of the district is given at $386,228,087 for 32 years.

Butte

Jan. 10—John Gillie, general manager of the Anaconda company, testifying recently in the Peter Geddes suit involving the Alice company, stated that the Alice property has been outside of the producing area of Butte for 16 or 17 years, or ever since the drop in silver prices. He said that the Anaconda company had decided upon the absorption of the different mining companies in Butte for the purpose of avoiding expensive litigation and to effect a saving in operating expenses. Mr. Gillie stated further that between $5,000,000 and $10,000,000 had been spent in the last 10 years in Butte upon unproductive mining properties, adding, however, that there is justification for a reasonable expenditure for development in the Butte district, on a reasonable showing. Asked with regard to the abandonment of the smelteries in Butte after the companies owning them had been absorbed by the Amalgamated company, Mr. Gillie asserted that it was done in the interests of economy, stating that the ores could be treated at the Washoe smeltery at Anaconda at a saving of from $1.25 to $2 per ton, stating,

as an example, that the Butte & Boston company was handling 700 tons of ore per day in 1905 and that the company saved over $500,000 yearly, by sending the ore to Anaconda for treatment. Even greater economies resulted after the Parrot, Colorado and M. O. P. smelteries were closed, he said. He gave the present production of the Butte Coalition mines at 1100 tons of ore per day, that of the Clark mines at 1100 tons and of the Trenton company at 700 tons.

On Jan. 2, in Butte, a meeting was held, at which time the properties, water-rights and improvements of the Southern Cross company in the Georgetown mining district, passed into the hands of the Anaconda company, the consideration being $450,000, which netted the former owners about 91c. per share. The property consists of the following claims: Southern Cross, Pleiades, Nellie, North Star, North Star No. 2, Keno, Sol Genzberger, Trinity, Lee Mantle, Apex Fraction and part of the Mundo.

In the suit of Richard Hancock, minor, and 16 other heirs of the late Richard Hancock, against the Anaconda, and Boston & Montana companies, which was brought some months ago for a one-tenth interest in the Wild Bill claim, and for an accounting of the profits of the ore taken out during the last 22 years, judgment was given by Judge Lynch, of Butte, on Jan. 9, in favor of the Anaconda company.

Salt Lake City

Jan. 11—The Ohio mill is at present handling 2000 tons of ore per day. The recovery on some of the ore is as low as 17 lb. copper per ton and the silver and gold in the ore is reported to bring 20c. net per ton. It is understood that the company is making some profit on its operations, at the present price of copper. Sixteen of the 20 Wall rolls are in operation. There has been some delay in their installation, but when all are in place it is expected that the mill will handle about 3000 tons per day. There are two vertical, fine-crushing sets of rolls, 42 in. in diameter and about 15 in. long. These rolls have a cast-iron core with manganese-steel shells. They have a daily capacity of 350 tons each, but at present are not being operated up to this amount. There has been trouble with improper feeders. The rolls crush fine enough to separate the mineral from the rock, without further crushing, about 20 mesh or finer, and consume less power than other crushing devices of the same capacity. The operation of the Wall rolls is being watched with interest. It was originally planned to install 10 corrugated rolls and 10 of the vertical type, but this number may be increased, so that eventually the mill will have 14 corrugated and 16 vertical rolls. The corrugated rolls do the coarse crushing, while the vertical rolls are for the finer work.

The recent snows in Salt Lake Valley and other parts of the state indicate a plentiful water supply for the coming summer. According to the local U. S. Weather Bureau, the rains and snows early in the season, with alternating temperatures, caused an ice foundation for the later snows, which are piling up. The early ice formation means that the snows are melted gradually, which is apt not to be the case when the snow is loose.

The Centennial-Eureka power plant, at the portal of the Holden tunnel in Tintic, was put in operation the first week in January to supply power for the large electrical pumping equipment in the Centennial-Eureka mine. Power has heretofore been received from the Knight company, but line trouble made it impossible to secure all the power needed. The Centennial-Eureka steam plant was built as an emergency plant for cases of this kind and is well equipped and capable of supplying power at all times. This is the first time the plant has been in operation since the final tryout following its completion.

Deadwood, S. D.

Jan. 12—Judging by present indications, the Black Hills district is to have a prosperous year during 1912, perhaps the most prosperous one since the discovery of gold, 37 years ago. The gold production is gradually growing, the last three months of the year showing a greater production than any previous quarter. According to Assayer-in-Charge L. P. Jenkins, of the U. S. Assay Office at Deadwood, bullion was purchased at that institution during the quarter ended Dec. 31, to the total of $2,043,319. The total of the year's business at that office was $7,490,864. This office does not handle the entire bullion output of the Black Hills, nor do the figures given above include smelting ores shipped to Denver, Omaha and other points. Aside from the producers now in operation, there will be several others running within the next few months, so that the year 1912 should exceed 1911 by a considerable amount.

Montreal men, represented by Wood Brothers, have taken an option on the Hidden Fortune and Columbus properties and will immediately dewater all the workings and make a systematic examination of the properties. An assay office has been rented in Deadwood, where the several thousand necessary assays will be made. Two electric pumps have been ordered for handling the mine water.

Continued cold and snow have caused inconvenience at a number of properties, and in fact have caused a suspension of construction work at one or two points. The railroads engaged in hauling ore have found it difficult to keep their lines open, and at present are using extra crews on all lines. The official measurement of the snow fall shows that 5½ ft. have fallen since winter began, and only a trifle of it has melted, as there has been but one good thaw in the last seven weeks.

Sudbury, Ont.

Jan. 8—The last year has seen a noteworthy increase in the demand for nickel, to meet which the two operating companies in this district, Mond and the International, have enlarged their plants, and the latter is now again to increase its smelting capacity by the addition of two more furnaces. Mond's new smeltery at Coniston is expected to be in operation by the end of this year, and each company is also opening up a new mine which should be in the shipping class by Jan. 1, 1913. Several nickel properties have been purchased and nearly every nickel claim that is for sale is now under option.

One great impetus in late years to mining in this district has been the extensive railroad development. Within two years the Canadian Northern R.R. will have its main line completed, thus giving Sudbury a competing line to both Toronto and Montreal. Besides this the Ontario Government road is expected to extend a line to Sudbury which will then give entrance to the Grand Trunk Pacific and will place Sudbury on the three transcontinental roads.

Parral, Mexico

Jan. 10—The opening of the American Smelting & Refining Co.'s mines in the Santa Eulalia district will probably have some effect in influencing some of the smaller mines and prospects to resume work. The smelting company's mines were shut down some time ago in order to make repairs; most of these have been completed and operations are now in progress as before. Negotiations are said to have been going on for some time for the transfer of several inoperative properties; it is believed that some of these, at least, will be successfully consummated soon. In the Perrazas district the smeltery of the Rio Tinto company is expected to resume operation soon. It has been closed temporarily for several weeks due to breakages in the machinery, which have now been repaired. In the Cusihuiriachic district a number of privately owned mines are working steadily and shipping ores to the smeltery. It is generally believed that the recent favorable turn in the political situation will have a salutary effect on mining throughout the several states, which will be noticed first, probably, in Chihuahua, and which will probably result in the resumption of activity at a number of properties.

The Mining News

The Current History of Mining

Alaska

The steamship "Northwestern" reached Seattle, Jan. 3, with 1900 oz. of gold dust and nuggets from Fairbanks, from which over $33,000 were netted.

Newsboy—The 5-stamp mill at this mine, in the Chena district, is completed, and the ore from the trial run shows an average of $22 per ton.

Lucky Hill—This company has been incorporated by Carlson Bros. & Whitely, of Fairbanks, for the purpose of operating both placer and quartz properties along Valdez Creek.

Spaulding—New machinery is to be installed on this property, at the head of Dome Creek, owned by the Reliance Mining Co., Fairbanks.

Frederick—This company is considering the installation of a compressor plant for the mine, near Ridgetop, on the Tanana Valley Railroad.

Alaska-Mexican—During November the mill crushed 19,312 tons of ore, yielding $55,521 gross and net $23,959. Operating expenses were $28,367; construction, $3195. The ore yielded $2.91 per ton and 208 ft. of development work were done.

Alaska United—During November 38,942 tons of ore were crushed, which together with 575 tons crushed in the Mexican mill yielded $92,343 gross and net $35,998. Operating expenses were $53,197; construction, $3146. The ore at the Ready Bullion mill averaged $2.32 per ton; 700-ft. Claim, $2.45. A total of 534 ft. of development work was done.

Arizona

Gila County

Two hundred white and Mexican laborers are reported to have attacked a dozen Japanese workmen recently, at Hayden. It is said that everything except their clothes was taken from the Japanese and they were then ordered to leave town.

Arizona Commercial—President Smith is at the property and is preparing to recommence development work in the Copper Hill end. A superintendent will be selected in a few days.

Inspiration—Work has started on the dam across Pinal Creek. This will be the chief source of water supply for the concentrator and will be built of concrete rubble masonry, 75 ft. long and 25 ft. high. There will be a concrete forebay and a tunnel to connect with the pumping station. The method of concentration recommended by J. M. Callow is being tested by him in the experimental mill. It is designed to be an improvement on the roughing system as practiced in many of the large mills of the country and aims, first, by means of graded crushing, to produce a comparatively small amount of slime, and second, by application of the roughing system, without classification, to remove the greatest possible amount of copper from the slime before it is separated from the sand and sent to the slime-treating machinery.

Live Oak—Churn-drilling operations have been curtailed, two drills having been closed down. The remaining drill is stated to be in ore above the average. The station on the 900-ft. level in No. 2 shaft, near the western end of the property, is virtually completed and it is intended to begin driftng on the ore soon. At the eastern end of the orebody a drift is being driven from No. 1 shaft, on the fourth level, and is reported to be faced in ore. Raises are being driven from this level on two of the churn-drill holes.

Miami—The December output amounted to nearly 3400 tons of concentrates which should yield over 2,580,000 lb. of refined copper. The grade of ore mined and milled during December averaged 2.6% copper, and the daily tonnage now being handled is about 2500 tons, of which about 12% comes from the dump, 35% from square-set and sublevel caving operations, 35% from development and the balance from shrinkage stopes. At the east side of the mine, ore is being mined by square-sets and sublevel caving, and in the northwest part by shrinkage stopes, there being in this part of the mine an available tonnage of 2,740,000 tons. The total developed tonnage above the 420-ft. or first tramming level is over 9,000,000 tons. The crosscut from the main shaft, on the 570-ft. or second tramming level, is in 475 ft. and has 250 ft. more to go to reach the orebody. The equipment of the pumping station at Burch now consists of two Aldrich triplex pumps, each driven by a 400-hp. motor and having a capacity of 1600 gal. per min. An air compressor has recently been installed to furnish air for air-lift pumping in testing some wells in the vicinity of the pumping station, one of which is now flowing at the rate of 250 gal. per min. and is increasing. The total number of men employed is over 700, of whom 370 are underground, 120 in the mill and the rest in the power house, shops, etc. B. B. Gottsberger is general manager; N. O. Lawton, mine superintendent, and F. W. Solomon, mill superintendent.

Barney Copper Co.—The General Development Co. has taken an option on the 26 claims of this company lying to the northwest of and adjoining the Live Oak, for $600,000, and is preparing to explore the ground by drilling. The principal work done by the Barney company consists of two shafts, 46 and 400 ft. deep. A drill is now being set up at the 400-ft. shaft, which is about 3000 ft. west of the east end-line of the property. E. B. Tinker, superintendent of the Keystone mine, has charge of the work.

Old Dominion—The production of fine copper for December was 2,587,000 lb., making the total for the year 26,500,000 lb., of which about 19,000,000 lb. were produced from the Old Dominion property, the balance being from United Globe and custom ores. Sinking of the A, or main, shaft to the 18th level is progressing satisfactorily, having passed the 17th level. The bottom of the shaft is now in quartzite and making considerable water. The contract has been let for lining the Kingdon shaft with concrete for 1000 feet.

California

Amador County

Hanby—This mine, which is being sampled and the ores from which are being tested by a mill run under the supervision of George Kislingbury, of Los Angeles, is situated near the line of Calaveras County and near Mokelumne Hill. It is reached *via* Valley Springs, through Calaveras County; this and other mines in the vicinity in Amador County are classed with the Calaveras mines.

Wildman—This property, at Sutter Creek, is reported to have been sold to William J. McGee, of San Francisco, who recently reorganized the control of the Keystone property. The Wildman and Mahoney mines, which adjoin, were worked and known as the Wildman-Mahoney, and were among the largest producers on the Mother Lode 25 years ago.

California Exploration Co.—Articles of incorporation have been filed for record. Capital stock is £50,000, divided into 50,000 shares. The directors are Lewis E. Lawton, L. J. Romer, Basil Perry Bell, E. H. Goodwin, Alfred Whittard, W. H. Nicholson, W. F. Witt, residents of Eng-

land; the head office is in London. Albert Burch, of San Francisco, is the representative of the directors. The company is installing a hoist and other machinery to reopen and develop the Plymouth Consolidated mines.

BUTTE COUNTY

El Oro Dredging Co.—Dredge No. 1, at Oroville, sank on Dec. 22, bow down, in 19 ft. of water. The bow was submerged, the stern remaining above water. The boat inclined about 7° from the water line after sinking. The primary cause of the tipping was the excess weight of machinery. No damage resulted and the boat is being raised.

Pacific No. 1—This dredge, which sank in 26 ft. of water on Nov. 27, at Oroville, has been raised, and the damage to the conveyor frame repaired. The recommissioning of the dredge was delayed by the installation of new cross-system, gold-saving tables.

FRESNO COUNTY

San Joaquin—A strike of high-grade ore is reported from this mine, 20 miles above Pollasky. W. W. Gibbons is manager. Extensive development and milling operations are reported in this section, known as Temperance flats.

KERN COUNTY

Teagle Brothers—This firm has received a dry-washing machine similar to that operated by the International company, and will operate it on the placer claims near the Baltic mine.

International Manufacturing & Mining—Two tons of concentrates from the dry washer, recently installed between Randsburg and Atolia, have been milled at the Red Dog mill, and are reported to have given fair returns.

Buick Lease—Well No. 2, near Fellows, came in on Jan. 8, flowing at the rate of about 10,000 bbl. per day. The oil gushed 200 ft. above the derrick. The well is down 3319 ft. with 6¼-in. casing.

Bellridge Oil Co.—By deed of Jan. 5, 30,000 acres of oil land, embracing the Hopkins tract, between the Lost Hills and McKittrick fields, have been conveyed to this company. A mortgage for more than $500,000 accompanies the deed.

SIERRA COUNTY

Monte Cristo—In this gravel mine, near Downieville, from which nearly $400,000 were taken out during the last 10 months, by a small crew of men, a drift is being driven to strike the vein where it has been undisturbed by dikes. F. I. Phelps is manager.

Sixteen-to-One—This mine, at Alleghany, has 10 men employed, is crushing and concentrating sulphurets at the Red Star mill, and is sacking its high-grade ore for shipment to the smeltery. W. I. Smart is operating the property under bond.

Fruitvale—The tunnel, which is in more than 500 ft. on the vein, will be extended this winter to cut a chimney of high-grade ore that outcrops. J. J. Fitzgerald is manager.

Telegraph—This gravel mine, on the Mountain House-Goodyear Bar belt of serpentine, where a strike in quartz was recently made, is taking in a large supply of air pipe, steel rails and provisions, preparatory to prosecuting a large amount of development work this winter and during the coming year. John W. Finney is superintendent.

TUOLUMNE COUNTY

App—The reported sale of this and the Rawhide mines by W. A. Neville, had not developed up to a recent date. The properties have been examined by representatives of the proposed purchasers, and the abstracts and other documents inspected. The sale has been so insistently reported that the supposed plans for development have also appeared as part of the report.

New Albany—This mine, which has been disturbed by litigation, has been temporarily closed down by order of the owner, the United Mines Corporation. Mr. Hinds, president, has returned to Cleveland, Ohio.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

The total output of Gilpin County for 1911 is given as 76,745 tons, an increase of 33% over 1910. The Frontenac mill is stated to have treated 35,736 tons of ore at a total cost of $2.83 per ton, including mining. The Frontenac company owns the Frontenac and Aduddell mines in the Russell Gulch district. H. P. Lowe is manager.

Pittsburg—This mine in the Russell district is making shipments of high-grade ore, returns having been received of lots that carried 14 oz. gold per ton and good silver content. Sixteen tons of mill dirt returned $121 from the gold caught on the plates. Drifting is being done on the 800-, 1000- and 1100-ft. levels.

National—A discovery of lead ore is reported from this mine at West Argentine, the vein, where intersected by a crosscut tunnel 190 ft. long, showing 4 ft. of galena; it is 120 ft. below the surface and is being opened for stoping.

Princess of India—Two cars per month of 200-oz. silver ore are being shipped; the shoot is said to be 100 ft. long and the ore is gray copper, 18 in. wide.

Lost Treasure—High-grade silver ore has been uncovered in this mine, on Columbia Mountain.

Pulaski—This mine, on Leavenworth Mountain, has been taken over by a syndicate of Denver men, with B. F. Kelley as manager; the old workings will be cleaned out and a force of 25 men put to work. Many years ago this mine was a producer of high-grade silver ore.

Baker—In this mine on McClellan Mountain, an 8-in. streak of ore has been discovered which assays $180 per ton in gold, silver, lead and copper.

Paymaster—Heavy shipments of $90, silver-lead ore are being made by pack trains to Georgetown from the mine in East Argentine.

LAKE COUNTY—LEADVILLE

Great Hope—It is reported that a small vein of high-grade ore has been opened in this mine. It was found in a drift run from the Across-the-Ocean shaft and at a depth of about 400 ft. Thomas Gilroy is manager.

Alps—It is reported that the Cleveland fissure has been cut by a drift run from the 175-ft. level of this claim in Little South Evans Gulch, and that it is 40 ft. wide with well defined walls; on the hanging wall there is 15 ft. of iron ore of low grade. The Alps shaft is 1½ miles from the Cleveland and the vein in the intervening ground is undeveloped.

New Discovery—In this mine, on Fryer Hill, M. H. Hoffer & Co., lessees, have opened a body of carbonate-of-zinc ore at a depth of 100 ft., 2 ft. of which carry about 37% zinc; this ore will be shipped. Outside of this is ore which will run about 23%, which will be stocked, pending a market for it.

Big Chief—In the incline from the 800-ft. shaft, now down 70 ft., a body of carbonate-of-zinc ore, 12 ft. high, has been opened that averages 33%. A 22-hp. electric hoist will be installed at the top of the incline. The mine is on Carbonate Hill.

Castle View—Twenty-five tons per day of lead ore are being sent to the smeltery from this mine, and 25 tons per day of zinc ore from the Crescent and Catalpa.

MESA COUNTY

The discovery of natural gas is reported at four places in the eastern end of the county and has caused considerable excitement. A company has been formed by Pennsylvania men and wells will be drilled.

SAN JUAN COUNTY

American Placer—Dispatches state that this company is preparing to work the placers in the San Juan River. A good equipment of machinery has been freighted in and buildings erected during the last summer; the dredge is now being assembled for operation next month. It is said that $500,000 have already been spent in the undertaking.

SAN MIGUEL COUNTY

Colorado Carnotite Co.—It is reported from Telluride that Manager O. B. Wilmarth has contracted the output of these mines, and made arrangements in the East for a market for the vanadium-uranium ores.

Illinois

International Smelting Co.—This company is reported to be contemplating the construction of a $1,000,000 smeltery and lead refinery, between Hammond, Ind., and Chicago, to employ about 1000 men.

Michigan

Copper

Victoria—A crosscut driven from the 12th level drift, encountered an exceptionally good run of copper ground. In driving the drift the copper-bearing portion of the lode was missed and the crosscut was driven to pick it up again. Good ground has also been recently opened at the 19th and 22d levels. The underground conditions at the property are more encouraging than at any time in its history. About 500 tons of rock per day are being handled at the mill.

Mayflower—Drilling of No. 17 hole has started at a point about 200 ft. east of No. 16 hole from which a good core was extracted. No. 17 hole will go down vertically and will cut this formation at a shallower depth. Upon the completion of this hole, shaft sinking will probably be started to open and develop this formation.

Houghton—The crosscut has passed through the copper-bearing formation that was at first believed to be the lode; it has been shown that it was not the main formation, but only a seam. The crosscut is being continued and should cut the main lode at any time.

Allouez—This property is rapidly developing into such shape that it will, in all probability, be the next producer at the Lake, to enter the dividend list. The surface equipment at No. 2 shaft is being rushed to completion, and as soon as this is accomplished, production will be about doubled.

Mass—This property will be able within the next few weeks to increase production materially. The shaft house at B shaft is about completed and when this is ready a larger tonnage will be handled. About 250 tons per day are being shipped to the mill. At the mill some changes have been made toward greater efficiency and everything about the property is progressing satisfactorily. The work at C shaft is necessarily slow, owing to the weather which has been unusually severe for the last two weeks.

Naumkeag Copper Co.—It is reported that the flotation of this company will soon be made by the General Development Co., a Lewisohn organization. The new company is expected to take over the Naumkeag, South Side and Dacotah properties, also some land from the St. Mary's Mineral Land Co., situated west of the Isle Royale and on the south side of Portage Lake, presumably in the southwest quarter of S.34—T54—R34. Superficial exploratory work was done on the first-named properties some years ago; developments in the Hancock company's vertical shaft during the last two years, however, have had a direct bearing on these properties, making them desirable tracts for exploration.

Hancock—The vertical shaft has encountered a branch of the main Pewabic lode, at a depth of about 3220 ft., which contained copper. This is the second copper-bearing lode encountered in the shaft during the last six weeks.

Wyandot—A strike was made recently in the crosscut at a depth of 700 ft., but details have not been announced. Development is confined largely to driving this crosscut east.

Elm River—President Fay has announced that the directors have voted to reopen the right to exchange the stock for shares of the Contact Copper Co., as outlined in a previous circular, on condition that interest at 6% from July 1, 1910, be paid on the cash payment required to cover subscription for additional shares. This offer expires Jan. 31, 1912. At the property, hole No. 10 is being drilled at an angle of 50°, and is about 200 ft. deep. This hole is expected to produce important results as it will pass through the eastern horizon of the series, where many of the recent discoveries at the Lake have been found.

Iron

Rogers—At this property of the Munro Iron Mining Co., situated three miles east of Iron River, 75 ft. were made in sinking the 11x16½-ft. shaft in rock, during December. The work is a continuation of the concrete sand shaft, sunk 140 ft. to bedrock last summer by the Foundation company. Walter Gulgren is in charge of the sinking. It was feared that the heavy water pressure in the thick overburden would give trouble when the work was begun in the rock, but little trouble was experienced.

Saux Head—Exploratory work has been resumed at the company's property near Birch, about 30 miles northwest of Marquette. Frank Krieg, formerly postmaster of Birch, is in charge of operations. The shaft was sunk to 100-ft. depth about 10 years ago by Marquette men in search of gold. It will now be sunk deeper. Indications of copper and iron are said to be present.

Newport—The company has instituted a suit protesting against the raise in the assessment of the mine, at Ironwood. The state's valuation of the mine was recently changed from $1,471,061 to $8,535,000, making a tax of approximately $100,000 to be paid.

Jones & Laughlin—The company has started sinking a permanent shaft on its 40-acre tract, one mile north of Iron River. The property has been thoroughly diamond-drilled. Will Walters is superintendent.

Moro—This Cleveland-Cliffs mine in the city of Ishpeming which will be closed down soon due to exhaustion of the orebody, has produced about 900,000 tons of hard, specular, high-grade ore. The percentage of iron in the ore regularly ran close to 60%; the moisture content was about ½ of 1%. The high phosphorus prevented the ore being bessemer. The greatest vertical depth of the shaft is 812 feet.

Montana

Butte District

Anaconda—At the Mountain View mine an electric motor for ore hauling has just been installed on the 1800-ft. level, heavier steel has been laid and all of the principal crosscuts and drifts widened and retimbered on that level. The new motor weighs four tons and is capable of hauling a load at the rate of about six miles per hour. It can haul 24 loaded mine cars, whereas the ordinary load for a horse is eight cars; these cars hold 14 cu.ft., which amount to approximately 9 cu.ft. of unbroken rock. A car of first-class ore, which has a larger copper content than second-class, weighs about three-fourths of a ton, while a car of second-class ore weighs about two-thirds of a ton. Motors are now being used as ore carriers on three levels of the mine, the 800-, 1100-, and 1800-ft. levels. The air shaft is being repaired and new guides installed in a number of places where settling ground has caused the shaft to squeeze. The 1600-ft. level air-shaft station is being enlarged. At the Pennsylvania mine, motors have been in use as ore carriers for over a year on the 1600-ft. level, and now preparations are being made to install a motor on the 1000-ft. level. The flume between the Pennsylvania and Leonard mines is nearing completion.

Butte-Alex Scott—As a result of the improvement in the copper metal prices, the management has decided to double the output of the mine, and in the future about 100 tons of ore per day will be shipped to the East Butte smeltery for treatment. The Little Annie mine, also owned by this company, which is a silver property situated north of Walkerville, has been leased to R. J. Philpot and others of Butte, and they will mine it on a royalty basis.

Butte & Ballaklava—The shaft has been sunk to the 1600-ft. level, where a station has been cut, and crosscutting begun for the purpose of intersecting the vein opened above on the 1400-ft. level. This vein contains 4 ft. of ore averaging between 5 and 6% copper, and a considerable width of lower-grade ore, and the management anticipates finding a still better grade of ore at greater depth.

DEER LODGE COUNTY

Butte-Anaconda—At a recent meeting of the directors it was decided to continue development work with a view to beginning shipments as soon as the snow is gone. The company owns two patented quartz claims, eight unpatented quartz claims and several placer claims, millsites and water rights, situated in the Georgetown district, near the Southern Cross property, and adjoining the Hidden Lake claims. Gonsiderable development has been done on the property in the past and about $50,000 worth of ore shipped.

JEFFERSON COUNTY

Corbin Copper—A vein of silver-lead ore averaging from 4 to 7 ft. in width, has been encountered 1500 ft. from the mouth of the Bonanza tunnel; a shaft is being sunk on this ore and four raises are being put up to connect with the Dewey tunnel, which is 207 ft. above the Bonanza. A vein containing copper and silver has been opened in the Rosalie tunnel and the ore is being shipped to the smeltery. The Dow tunnel is being driven to intercept the Minah lodes at a depth of 900 ft., where, basing their expectations on the Minah claims adjoining, the management hopes to find high-grade copper ore. The concentrator has been started and will be run at the rate of one shift per day, its capacity when running full being 200 tons of ore per day.

MADISON COUNTY

Pennington—A lease has been taken by C. O. Dale on this mine, which has produced considerable rich gold ore in the past; owing to the gold lying in pockets, necessitating much dead work, it has not been worked recently. Operations are expected to start soon.

Nevada

COMSTOCK LODE

Mexican—The finishing touches are being made to the new 100-ton mill, and the plant will soon begin the treatment of higher-grade ore. The classifier was found inefficient in the experimental run made on vein rock, and two plates were defective in the tube mill, but these have been remedied and further test is now underway. In the mine, sampling is being thoroughly done, preparatory to stoping ore on the 2300-, 2400- and 2500-ft. levels.

Con Virginia—The southwest prospecting drift on the 2550 level has passed through the high-grade ore encountered recently, and the face of the drift is in a mixture of porphyry and quartz of a favorable character. The formation being followed is a strong one, and the cars have averaged about $16 per ton, recently.

Union—The extensive repairs to the shaft that have been underway for two months from the 2000-ft. point to the surface, are now practically completed, and the shaft is in excellent condition. The Mexican company works through this shaft and when stoping begins in that property, the hoisting facilities will be ample.

Ward—Diamond drilling has started from the Ward raise in the Julia connecting drift on the 2000-ft. level, toward the Gold Hill section, but no water had been tapped at last reports.

C. & C.—The transformers for the new pumping system to be installed on the 2460 station, which is now nearly completed, have arrived, and the motors from the General Electric Co. were shipped recently from the East. The new pumps, that are designed to unwater the north-end mines from the 2500 to the 2900, are expected to be installed by the first of July.

Ophir—The directors have appointed a committee to investigate the advisability of acquiring a reduction and cyanide plant for the company, but nothing definite will be done until spring, when the weather conditions will be favorable for the construction of works of this kind. The company has nearly $100,000 in tailings stored and is maintaining regular ore shipments to the Kinkead mill.

ESMERALDA COUNTY

Goldfield Consolidated—An official notice issued by Secretary Howe states that the issuance of the annual report will be delayed about two weeks, to permit of a rearrangement of accounts to accord with the requirements of the federal corporation income tax.

Goldfield-Belmont—A recent shipment is reported to have averaged $77.20 per ton. This ore was not sorted but was shipped as broken in development work, some of it running up to $1700 per ton. Ore is being broken at the rate of 25 tons per week.

HUMBOLDT COUNTY

The placer properties in American and Limerick Cañons are preparing to operate this spring; it is expected that with uptodate dredges, much more placer gold can be taken out than formerly. Limerick Cañon is in the vicinity of Lovelocks, Nevada.

Nevada Gold Crown—This company of Golconda, Nev., J. H. Playter, manager, is preparing to install heavier machinery to handle the great increase of water coming into the shaft. A body of gold ore was struck recently but the water prevented mining.

Slumbering Hills Mining Co.—This company has been formed lately with substantial backing, and will take hold of a number of placer claims in Barber Cañon, in the Humboldt Range. These claims cover the old workings of the Chinese of many years ago. The gravel runs from 10 to 35c. per yd. and there is plenty of water to enable the company to operate a dredge; the distance down to bed rock in some places is 80 ft., and is reported to be pay gravel the total distance. Denver men are interested and J. B. Truett, Mill City, Nev., is field manager.

Cortez—This mine, 50 miles south of Beowawe, Nev., is preparing to resume operations; the property was a producer years ago when silver was at a high price. J. B. Menardi, of Reno, is the principal operator.

NYE COUNTY

MacNamara—The mill is nearly completed, the last car of machinery having arrived recently. It is the intention of the management to put through the surface dumps first, as these contain some high-grade ore. While this is in progress, underground development work will be done.

Jim Butler—Shipments for five weeks ended recently, averaged as follows: First week, $70; second, $98; third, $180; fourth, $43, and $100.50 for the fifth week.

WHITE PINE COUNTY

Nevada Consolidated—Cold weather has interfered with operations at the Steptoe concentrator, freezing of water pipes having recently reduced the number of sections in operation from eight to six. At Copper Flat four shovels are working in overburden and two in ore. One shovel is removing overburden at the Liberty pit.

Giroux—New construction is proceeding slowly. The main timbers of the 90-ft. headframe are in place, and the engine and boiler houses are inclosed, four boilers being in place. One churn drill is in operation on the ridge between the Morris and Giroux shafts. The company is experiencing trouble with the freezing water system.

New Mexico

Ernestine—A 90-day option on this property is reported to have been given to Henry B. Hovland, of New York and Duluth, Minn. It is further stated that engineers will make a complete and thorough examination of the property. The value of the monthly production is said to be about $35,000 at present, of which $16,000 are profits. This production can be easily increased.

Oregon

Agate—This company is developing the Big Creek mines, near Newport, Lincoln County. The property contains black sand, carrying gold and platinum. The plant is not completed and was manufactured by the Gold & Platinum Extraction Co., of Los Angeles, Calif. The management states that it is expected to work from 400 to 600 cu.yd. of beach sand per 24-hr. day.

Utah

Beaver County

Horn Silver—The orebody cut about a month ago on the 400 level has been drifted on 35 ft., and crosscutted for 15 ft. It is reported to run $10 to $12 per ton.

Michigan—Officers for the ensuing year have been elected, Lawrence Green being chosen president. Drifting is being done on the 200-ft. level, south of the shaft. The drift is in 275 ft., and has cut ore in a number of places. The ore carries lead and copper and occurs up to 31 in. thick. The present work is in porphyry and the drift is being extended toward the limestone contact.

Progressive—A car of about 30 tons of ore is on the local market, which assays 9.28% copper, 31.6 oz. silver and 0.04 oz. gold. The total value is about $899. This ore came largely from an incline 70 ft. below the 150-ft. level.

Juab County

Lower Mammoth—At the annual meeting, Jan. 8, the financial statement was presented, showing receipts for the year, including two assessments, to have been $37,225. There was an overdraft, Jan. 1, 1912, of $5091. Thirty-three cars of ore were shipped during the year, largely by leasers, amounting to 1334 tons, which sold for $8916. Development was done on the 200, 300, 400, 1000 and 1700 levels. Leasers worked in various parts of the property up to September.

Grand Central—New ore is reported to have been followed on the 1600-ft. level for about 80 ft. Copper ore is being mined on the 2200 level and development work is being carried on there, and in other places. The output for the week ended Dec. 15 was nine cars.

Utah Mine—A car of ore has just been marketed from this mine, at Fish Springs. Up to Jan. 1, 1912, the property has produced $1,198,000, and has paid $325,000 in dividends. During 1911, 25 cars were shipped, amounting to 730 tons. The ore averaged about $86 per ton, making the total value of the output for 1911, $62,780. The wagon haul from Fish Springs to Oasis is about 70 miles and costs $12 per ton. The property is reported to have operated steadily for the last 20 years, never having levied an assessment.

Salt Lake County

Utah Copper—The seventh section of the Arthur mill will be in operation in a few days. The third Mallet compound locomotive for the Bingham & Garfield R.R. is now in use, and 80 steel ore cars are expected to arrive in a few days, each of 60-ton capacity. More equipment will be purchased as soon as a greater tonnage can be mined.

Summit County

Park City shipments for the week ended Dec. 30 amounted to 2,840,975 lb.; for the week ended Jan. 6, to 2,570,200 lb. The shipments for December totaled 9118 tons. The Daly West shipped 2931 tons; Silver King Coalition, 2898; Daly-Judge, 2233; Ontario lease, 585; New York, 171; Grasselli Chemical Co., 163; Silver King Consolidated, 83; Little Bell, 34; Charles Moore, 20 tons.

Silver King Consolidated—New ore has been cut in drifting from a raise 60 ft. above the 1550 level. The ore is a carbonate, running well in lead and silver. What is thought to be the same orebody has been reached from lower workings at a point about 60 or 70 ft. distant.

Tooele County

Cliff—Ore has been followed 40 ft. at the bottom of the incline from the lower tunnel. An electric hoist was recently installed here. Drifting was done in two directions from the bottom of the incline in shipping ore. This property is the chief producer in the Ophir district at present.

Lion Hill Consolidated—At a meeting, Jan. 6, it was arranged to provide $2000 per month for the coming 15 months. This money will be obtained from the sale of treasury stock, and used for development. The stock of the Lion Hill Mining & Milling Co. can be exchanged for that of the Lion Hill Consolidated, after October, 1912. Development work will be done chiefly from the East Side tunnel to reach the Chloride Point vein. During 1911, eight cars of ore were shipped, bringing in about $16,000.

Washington County

Bull Valley—This property, 35 miles west of St. George, has been bought by Provo men. There are four claims, covering a contact vein between limestone and porphyry, on which good gold assays have been obtained. Development will be started soon.

Washington

Yankee Boy—The tunnel on this property in Ferry County is being extended and the company is preparing for more extensive operations. J. M. Snow, Republic, is in charge.

Blue Star—This property in Stevens County has been leased to Tom Tomstad, of Chewelah, who will work the mine on a larger scale in the spring.

United Copper—Some good ore has been encountered at this mine averaging $100 per ton. The new machinery recently installed is now in operation and steady shipments are being made. Conrad Wolff, Spokane, is manager.

Golden Eagle—A body of rich ore has been encountered at this mine near Blewett, Chelan County. F. G. Ernest is general manager.

Wisconsin

Zinc-Lead District

Frontier—This company is moving the Hoosier mill to the Sedgewick property, and has commenced sinking a shaft on the Hird land, near Benton.

Vinegar Hill—The company is assembling the Empress and Wicklow roasters at the Wilkinson spur, near Benton, and will later add the Murphy roaster, making a three-kiln equipment for treating ores from its properties.

Mineral Point Zinc Co.—Kennedy mill No. 2, at Hazel Green, was totally destroyed by fire on Dec. 18. The fire originated from an electric spark.

Joplin Separating Co.—The plant, at Galena, that was destroyed by fire last year, has been rebuilt with concrete and steel and with an enlarged capacity.

Coker—This mine, at Livingstone, has rebuilt its plant that was destroyed by fire last August. This is one of the oldest and largest producers in the northern end of the field, and employs 14 rock drills.

Canada

British Columbia

British Columbia Copper—During the fiscal year ended Nov. 30, the company produced 9,969,926 lb. copper; 130,441 oz. silver and 30,742 oz. gold as compared with 7,143,456 lb. copper, 84,180 oz. silver and 24,962 oz. gold the previous year. During the early part of the year the cost was under 9½c. per lb. of copper. This was later increased by the coal strike.

Consolidated Mining & Smelting—It is reported that the company has bonded the Tiger group of claims, at Ainsworth, for $18,000. During the last year the company bonded several properties, including the Hudson Bay group at Deer Creek and the No. 1 at Ainsworth.

Ontario

Union Natural Gas Co. Ltd.—A charter has been granted to this company, capitalized at $3,000,000, to take over the business and franchises of the Volcanic Oil & Gas Co., Ltd.; the United Fuel Supply Co., Ltd., and the Ridgetown Fuel Supply Co., Ltd. The franchises cover a wide area in the western portion of Ontario. The provisional directors are A. S. Rogers, C. E. Calvert, D. E. Coste, S. L. McKay, F. E. Ogden, P. A. Little and Louis E. Willett.

Ontario-Cobalt

Nipissing—On vein 73 a raise completed from the 250-ft. level shows 82 ft. of ore, averaging 3 in. wide and assaying 2500 oz. per ton. To the east a raise has been made from the 250-ft. level and the vein found to be 5 in. wide of 2000-oz. ore. On the 250-ft. level the drift on the main orebody is 190 ft. long on a 3-in. vein assaying from 2000 to 2500 oz.

per ton. Operations on No. 100 vein show 3 in. of 3000-oz. ore at the 200-ft. level. Four veins worked through the Fourth-of-July shaft show a combined length of 405 ft. at the 200-ft. level.

Temiskaming—A car of ore comprising 31.3 tons shipped from this mine yielded 200,723 oz. of silver, estimated to be worth $110,397. It was taken from the 500-ft. level and is claimed to be the richest car of ore ever sent out from the camp.

Green-Meehan—At the annual meeting in Toronto on Jan. 12, the shareholders authorized the sale of the property for $150,000. The payments of this amount are to be extended over a period of six years.

La Rose—A deep-mining policy has been approved of by the directors for the main property. The winze put down from the 250-ft. level has reached a depth of 120 ft., where a station is being cut for development work. The winze will be sunk 100 ft. lower, giving the mine a total depth of 470 ft., at which level extensive crosscutting and drifting will be undertaken.

Coniagas—The company is opening new territory with good results and has encountered several promising veins at the 75-ft. level. At the eastern end of the property the winze put down from the 225-ft. level is 40 ft. deep in good ore all the way. While mine ore still furnishes over half the production, the mill is treating 186 tons per day of 36-oz. ore, at a cost of only 8.8c. per ounce.

Ontario-Porcupine

Standard—A new vein carrying free gold is reported to have been discovered.

McIntyre—This property has been shut down temporarily owing to a break in the compressor. A 28-ft. vein of mineralized schist and quartz has been opened in a crosscut from No. 1 shaft at the 200-ft. level.

Hughes—The main vein has been crosscut at a depth of 50 ft. and shows good assays.

Pearl Lake—The company has ordered new equipment of sufficient capacity to carry on underground operations to a depth of 1000 feet.

Dome Lake—A small plant will be installed on this property.

Crown Chartered—The Davidson shaft is being sunk to the 200-ft. level.

Preston-East Dome—The Preston claim has reverted to the original owners, on account of the last payment not having been made.

Dome—Another 12-drill, electrically driven compressor is to be installed. W. W. Mein has been appointed consulting engineer of the property and is now engaged in thoroughly sampling it. The steel work of the mill is finished and the latter will be inclosed soon. Four diamond drills are working.

Imperial—Several small quartz veins, all carrying visible gold, have been encountered in a crosscut at the 100-ft. level.

Ontario—Sudbury

Murry—This mine, together with other conveniently situated properties, is under option to a strong Canadian company, which has arranged for further development work by drilling. As this company will probably use the most of its output, it is expected to increase its holdings as fast as possible. Its advent should mean much for the future of the district.

Mt. Nickel—The mine which has been actively developed during the last year, by the Nickel Alloys Co., of New York, has shown up a large body of ore and it is reported that this mine together with the Trillabella and several more is under option to this company.

Canadian Copper Co.—The company has announced that the 8-hr. day will be adopted for all men working in the mines and the 9-hr. day for surface men. No reduction in wages will be made on account of the shorter hours.

Mexico

Chihuahua

Paul Ginther, of Santa Rosalia, who has organized a syndicate to take over a number of mines in the Parral and other districts, announces that he and his associates will install a large reduction mill and cyanide plant at Minas Nuevas, Chihuahua, and will also construct an aërial tram to connect the San Patricio mine with the proposed mill.

Perros Bravos—Shipments to the smeltery average about 1000 tons per month. About 200 men are employed, but the number is expected to be increased. The property is owned by the Pittsburgh Mining Co., but is under lease to P. B. Butler, who is the manager.

Nicolas Bravo—It is reported that a producer-gas plant will be installed on this property soon, as well as a new hoist. C. Delgado is in charge.

El Rico—The stockholders of this company will meet soon, to outline a campaign of operations for the coming year, and to elect officers. Manuel E. Flores is president.

La Princesa—This property is said to be shipping from three to four cars a week to the smeltery in Chihuahua. Over 100 men are employed, under the management of W. J. Wallace.

Mexican Mines—Driving the tunnel is going forward with three shifts. It is expected to encounter the orebodies in February. E. J. Earnest is in charge.

Mexico

El Oro—During December the mill crushed 31,030 tons of ore, yielding $206,610 gross and net $80,430. Working expenses were $112,910; development, $13,270; permanent improvement, $10,000; total profit, $86,930.

San Luis Potosi

Tiro General—The mine, which was taken over several months ago by the American Smelting & Refining Co., is being put in shape to double the output of zinc ore, which will be shipped to the American Smelting & Refining Co.'s smelteries at Aguascalientes and Matehuala. Recently a large force of peons were put to work widening the roadbed, preparatory to changing the present narrow-gauge road to standard gauge, thus eliminating ore transfer at Los Charcos, 12 miles from the mine. T. M. Hamilton is superintendent, and Leighton Stewart, mining engineer.

Sonora

Rich pay gravel is reported to have been found in La Cañada and Baboyohui rivers, about 40 miles southeast of Navojoa. Some excitement has been caused and prospectors are going in.

Tepic

El Frontal—This property is situated east of the town of Rosamorada, about six hours' horseback ride from the railroad line, and is owned by a company of Cincinnati, Ohio. A body of ore, 7 ft. wide, was struck last month, in a crosscut 250 ft. below the tunnel level. The mill and cyanide plant, erected two years ago, but not started for lack of sufficient tonnage, are being put in shape and will commence operations in February. The company also owns La Cucaraha prospect near the Southern Pacific R.R. station, Yago. There are a number of old Spanish workings on this property.

Minitas—This property, near Rosamorada, is steadily keeping up development work. The flow of water has been controlled by the installation of a pumping plant. According to records, this company was once a large producer. The company's representative, H. J. Thomas, of Ray, Ariz., was on the ground during December and acquired some claims from I. J. Hall, situated in the neighborhood of the town of Acaponeta, near El Tigre mine, which has been shipping high-grade gold ore to San Francisco for the last two years.

Central America

Costa Rica

A report from London indicates that an English company has purchased the lands belonging to the Valle del Condoto, and will exploit the platinum and gold deposits.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Jan. 17—Extremely cold weather still prevails over a large part of the country, with resulting activity in the demand for domestic coal. Steam coal requirements also seem to be improving. At the same time the trade has been subject to delays in transportation due to the weather, so that supplies at the larger distributing points are rather short, and there have been some temporary advances in price at several points. This is felt both in the West and in the seaboard trade. Anthracite trade is active for weather reasons. The coastwise trade has been in trouble owing to stormy weather, and rates are unusually high.

The general convention of the United Mine Workers met at Indianapolis, Jan. 15. Two or three days will be occupied in settling the claims of contesting delegations. The actual business of the convention has not been reached at the time of writing.

To bring the Lehigh Valley safely within that clause of the interstate commerce law providing that no railroad company shall have any interest in articles of commerce which it transports, the directors took action Jan. 11 to separate the coal-producing interests from the railroad's. For this purpose there is to be created the Lehigh Valley Sales Co. This concern will exist under a New Jersey charter and have an authorized capital stock of $10,000,000, of which $6,060,800 will be issued forthwith. Stockholders of the Lehigh Valley R.R. Co. will have the right to subscribe for this new stock pro rata at par, but they are not obliged to do so, and a banking syndicate will take any of the stock left. The directors also declared a special cash dividend of 10 per cent., which may be applied to payment for the new stock, or it may be drawn in cash. The Lehigh Valley and its controlled coal company will make a contract with the Lehigh Valley Coal Sales Co. by which the latter will buy at an agreed price all coal which the Lehigh Valley properties turn out. The new company will then own the coal transported, will pay the freight to the railroad and have all to do with the marketing of the coal. Between the Lehigh Valley R.R. and the new sales company there will be absolutely no legal connection.

Anthracite Shipments—Shipments of anthracite in December were 6,115,427 tons. For the full year the shipments by companies were, in long tons:

	1910	1911	Changes
Reading	12,445,733	13,265,758	I. 820,025
Lehigh Valley	11,195,765	12,603,000	I. 1,407,235
N. J. Central	8,519,135	9,218,802	I. 699,667
Lackawanna	9,589,076	9,869,620	I. 280,544
Del. & Hudson	6,578,356	7,206,731	I. 628,375
Pennsylvania	6,250,976	6,494,733	I. 243,757
Erie	7,554,198	8,800,179	I. 1,245,981
N. Y., Ont. & West	2,772,547	2,495,476	D. 277,071
Total	64,905,786	69,954,299	I. 5,048,513

The total increase in 1911 over 1910 was 7.8 per cent. Only one company showed a decrease. The shipments in 1911 were the largest on record. Of the total washery coal was 3,847,585 tons, or 5.5 per cent. of the total.

Iron Trade Review

New York, Jan. 17—The iron and steel markets continue active, and a large business has been done; perhaps not quite up to some of the highly optimistic predictions made in December, but quite enough to put the trade on a better footing than it has held for some time past.

In finished materials there is a steady demand for nearly all lines. Railroad orders for rails are being placed on a fair scale and a large tonnage is already booked. Orders for cars are coming in again, after a short period of quiet. Structural steel orders are also larger than they were.

Prices have an upward tendency, but actual advances have been small. There is still plenty of competition; and besides many sellers realize that any sharp advance would be a serious check to the present buying movement.

Pig iron is rather more active. Eastern steelmakers have contracted for a good tonnage of basic and for some bessemer pig. Foundry iron is in good remand, and prices are a shade firmer. Southern furnaces are less aggressive, though they are still on the lookout for business.

It is reported that several independent interests are planning to build large steel works at some point not far from Cleveland. The leaders in this movement are the Ohio Iron & Steel Co., of Lowellville, and Corrigan, McKinney & Co., of Cleveland. The last named company had planned to build steel works in connection with its present blast furnaces; but these plans may be merged with the larger undertaking. The reported combination will control a large body of Lake Superior ores.

The unfinished orders on the books of the Steel Corporation on Dec. 31 are reported at 5,084,761 tons. This is 942,806 tons more than on Nov. 30, and is the largest total reported since Mar. 31, 1910, when the total was 5,402,514 tons.

It is announced that the United States Steel Corporation has bought the plant of the Baltimore Bridge Co., Baltimore, and will establish a large warehouse which will be made an assembling base for export shipments for all products. The present fabricating business will be continued, but the importance of the transaction lies in giving the leading interest increased facilities for serving its export market from a favorable shipping point.

Pig Iron Production—The reports of the blast furnaces, as collected and published by the *Iron Age* show that on Jan. 1 there were 214 coke and anthracite stacks in blast, having a total daily capacity of 67,650 tons; an increase of 1050 tons over the Dec. 1 report.

Baltimore

Jan. 15—Exports for the week included 6,030,560 lb. steel rails and 760,071 lb. rail joints to Cuba. Imports included 13,165 tons iron ore from Cuba.

Birmingham

Jan. 15—Southern manufacturers of pig iron have been selling a little iron right along and are demanding a better price for the product. While the volume of business so far transacted this month has not been nearly as great as it was during the previous two months, the quotations have been firmer, very little iron being sold as low as $10 per ton, No.2 foundry. There have been several lots of iron sold in this section of the country during the present month, though many of them in two or three carlots, 100 to 200 tons, at a price equal to $10.50. There is a steady delivery of iron going on while the melt in the home territory has started out well. The make is off considerably; not only are there two furnaces out of blast, but furnaces which have been in active operation for some time have not been doing as well as heretofore. It is figured that the reduced production is likely to be felt for several weeks. However, two furnaces are about ready to blow in right now, while within the next 60 days two others will be in readiness.

Announcement is made that considerable iron has been sold into the export trade, the Tennessee and the Republic

companies selling between 20,000 and 30,000 tons for delivery in England and Austria.

First-quarter iron is selling at $10@10.25, while for the first half of the year, furnace companies are asking $10.50. There is hope expressed that the accumulated stock of iron will have been entirely sold off by the end of the first half of the year.

Cast-iron pipe is in good demand and the make in the Southern territory is to be increased shortly. No change in steel is reported. The steel plants, with the exception of the rolling mills, which are turning out fabricated steel, have not yet struck their usual gait.

Scrap iron is quiet. Charcoal iron is about holding its own, orders being received from time to time. Charcoal iron is selling at $22@22.50 per ton.

Chicago

Jan. 15—Considered as a whole, the market as yet shows no striking changes. There is, however, a general strengthening both of demand and conditions, which promises better conditions in the near future. The demand for pig iron has increased, from founders; they are willing to contract more liberally for the future and they hesitate less on purchases for the needs of the next few months; the tendency is to buy for prospective demands more generally and farther into the future. Southern No. 2 pig iron is selling at $10.50, Birmingham or $14.85, Chicago, while Northern No. 2 holds to $14 minimum at the local furnaces, though much iron is selling at 25 or 50c. more.

The tendency of foundry melters, who constitute the large buying element in this market, is to contract more largely for their supplies, to be delivered up to at least six months hence, and in some cases up to the end of the third quarter. The furnace agents, however, take the bull side of the market and are not inclined to future deliveries except at higher premiums than the melters are willing to pay. The market therefore resolves itself into a program of close watching, the selling element demanding advances over current quotations, which are for delivery in the next three months, and the buying element looking for its chance to contract largely before the upward change of prices shall become decided. There have been very few sales of pig iron above 500 tons and the sale of more than 1000 tons is a rarity. In times past this market has registered as much as 50,000 tons a month; it is doubtful if it now registers 30,000 as an average of the last few weeks.

Iron and steel products, such as structural material, bars, plates and sheets, show a general increase since the first of the year, with the local bar makers strong since Pittsburg bars have been held to 1.20c., Pittsburg, which means 1.38c., Chicago. The structural market shows a number of contracts for buildings in the West and Southwest and the sales of track and general railroad supplies, despite the unfavorable weather conditions, have been fair. The outlook, on the whole, is encouraging, though no one line is booming.

Cleveland

Jan. 15—Some inquiries are being made about ore prices, and it is said that there is to be a conference on this point very soon. Shipments from ore docks to furnaces in December were 773,503 tons.

Pig Iron—A number of large inquiries are out and some good sales are reported. Quotations are $15.15 for bessemer, $13.25 for No. 2 foundry and $12.50 for forge; all Cleveland delivery.

Finished Material—New business is moderate, but specifications on contracts are heavy. Prices are a shade firmer. Negotiations are said to be going on for a large tonnage of billets for shipment to Germany, to run over three years.

Philadelphia

Jan. 16—Rather a good business has been done in pig iron, especially in basic, while there has been more call for bessemer than we usually hear in the East. Pennsylvania furnaces seem generally full and are not on the hunt for business. No. 2 X has changed hands at $15, and basic at $14.25, delivered. Forge is about $14.25. A sale of standard low-phosphorus iron is reported at $19.25 per ton.

Steel Billets—More business is on, especially for forging billets. Prices are firmer.

Bars—Iron bars can still be had for 1.25c. and steel bars for 1.30c. A fair business is on hand.

Sheets—Mills are now well fixed for the next month or two, and are not making concessions.

Plates—Business has not been as heavy as expected, and 1.30c. rules, though 1.35c. is asked by some mills.

Pipes and Tubes—Pipes are quiet; tubes a little stronger on fair demand.

Structural Steel—No big orders have come up, but a better quantity of small work.

Scrap—Sales are improving and dealers are inclined to sit tight, and hold for good prices.

Pittsburg

Jan. 16—The finished steel market has been very quiet since the first of the year, and particularly so in the past week. There has been very little new business placed, while specifications have been barely equal to current production with the mills faring best, and have been considerably below current production with the mills not faring so well. These conditions have caused a decided chill in some quarters, and sentiment is not nearly as strong as it was in such quarters. In other quarters, however, it is pointed out that a lull at this time was expected, on account of inventory and other annual adjustments; besides the weather throughout the North has been extremely cold, practically stopping outside operations in most sections, so that great activity by way of specifying could not reasonably be expected.

The slackness in business has not affected prices in this territory on bars, plates and shapes, which are still firmly maintained on the basis of 1.15c., Pittsburg, with some mills holding out for 1.20c., or refusing to book beyond Apr. 1 at 1.15c. The mills are well filled with specifications in these lines, and can easily stand a month or more of quietness without having their operations interfered with. In hoops there has been a little cutting, one or two mills quoting 1.25c. on prompt specifications against 1.30c. usually held. In sheets there is reported a little shading and there are predictions in some quarters that competition will grow keener in this branch. In the Chicago district there is keener competition in steel bars, and 1.25c., Chicago, is still done freely, with occasional shading from this figure, which represents 1.07c., Pittsburg.

The Carnegie Steel Co. has blown in about half a dozen blast furnaces since late in December, but has not started the Columbus furnaces and steel plant as was expected. It is possible the plant will be started about the beginning of February.

The Connellsville coke market has been very much excited, production having been insufficient since the middle of December, owing largely to the celebration of so many holidays by the foreign workmen, the last being the Greek New Year this week. Prompt furnace coke has been selling at $1.85@2 the past week, against $1.50 in November, and is hard to get at any price. Contract coke is also stiffer, and the lowest that can be done is $1.80, while some operators are holding out for $2. To the difficulty of a short supply of labor has been added the cold weather of the past 10 days, making operations more difficult and interfering with the movement.

Pig Iron—Foundry and malleable iron have grown stronger, though not quotably higher. A sale of 1000 tons of standard malleable is reported at $13, Valley, for delivery over first half, and a sale of 1000 tons of car-wheel iron for about the same delivery at $12.45, Valley, this being iron 1.50 to 2 per cent. manganese and a little over 1 per cent. silicon. While sales on attractive orders for foundry iron have been made at the old price of $13, Valley, several sales have been made in the past few days at $13.25, Val-

ley. Bessemer and basic have been relatively quiet. We quote: Bessemer, $14.25; basic, $12.35@12.50; No. 2 foundry, $13 @13.25; malleable, $12.75@13; gray forge, $12,50@12.75, all f.o.b. Valley furnaces, 90c. higher delivered to Pittsburg.

Ferromanganese—The ferromanganese market is firm at the new price, though not active, and we quote prompt and forward at $41, Baltimore.

Steel—The steel market has been quiet as to actual transactions, but the mills are very well sold up and are adhering closely to regular prices. We quote bessemer and openhearth billets at $20, Pittsburg, and sheet bars at $21, with rods at $24.50@25, Pittsburg.

Sheets—While specifications have been coming in at a fair rate for sheets, new business has been light and some of the mills with not much business ahead are reported as likely to shade prices on good business. We quote regular prices at 1.90c. for black, 28 gage; 2.90c. for galvanized, 28 gage, 1.40c. for blue annealed, 10 gage; $1.33 per square for painted, and $2.47 for galvanized corrugated roofing.

St. Louis

Jan. 15—A number of foundries which have been on slow time or closed down temporarily for the holidays and which had been intending to open up full blast have postponed it owing to the weather which has been about 20 deg. below zero for the past week. Business has been only fair during the week, running mostly to small orders though some fair-sized inquiries have been received. The current quotation is $10.50 Birmingham or $14.25 St. Louis for No. 2 foundry. The prospects for the future are quite bright as the railroads have been buying a quantity of supplies and a large number of cars. The American Car & Foundry Co. is now running nearly full capacity at its steel-car plants and will probably be pushed to fill orders before long. In quiry for Northern iron has been light. Northern No. 2 is being quoted at $14.75@15.25 St. Louis.

Iron Ore Trade

It is announced that the Nova Scotia Steel Co. has contracted for 135,000 tons of iron ore from its mines at Wabana, Newfoundland, to be delivered at Philadelphia in 1912. It is also stated that the company has made contracts to deliver 225,000 tons to German furnaces. The yearly capacity of the Wabana mines is about 450,000 tons.

It is announced that the output of iron ore made by the Ponupo Manganese Co. this year, amounting to 150,000 to 175,000 tons, will be offered in the open market to Eastern furnaces. This is the first time any considerable quantity of Cuban ore has been sold in the open market; nearly all of it has been taken by the large steel companies controlling the mines.

Foreign Iron Trade

British Iron and Steel Quotations—For the first week of January business is reported active, and some quotations given may be of interest by way of comparison: East Coast hematite (bessemer) pig, $15.84; Cleveland basic and foundry, $12.18 per ton. For finished material: Steel shipplates, $33.60 per ton; iron plates, $31.20; steel angles, $33.60; iron bars, $33.60; all less 2½ per cent. discount. Steel rails were $27 per ton, net.

Metal Markets

New York, Jan. 17—The metal markets generally have been fairly active. Copper seems to have reached its highest point for the present and there is some tendency to reaction.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold:			
Nov. 1911..	$13,941,093	$ 3,458,321	Exp. $10,482,772
" 1910..	1,376,011	4,313,500	Imp. 2,937,489
Year 1911..	36,188,397	52,737,854	Imp. 16,549,457
" 1910..	57,444,422	54,245,886	Exp. 3,198,536
Silver:			
Nov. 1911..	5,052,238	3,338,956	Exp. 1,713,282
" 1910..	5,265,595	4,827,254	Exp. 438,341
Year 1911..	59,667,286	40,439,844	Exp. 19,227,442
" 1910..	51,299,913	41,479,718	Exp. 9,820,195

Exports from the port of New York, week ended Jan. 13: Gold, $1,32,147, principaly to Argentina; silver, $980,133, chiefly to London. Imports: Gold, $921,-508; silver, $452,902, both chiefly from Mexico and South America.

Gold—The price of gold on the open market in London continued at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Outside of moderate demands for Egypt, India and Argentina, most of the supplies arriving went to the Bank of England.

Gold production in the Transvaal in December is reported by cable at 709,-908 oz. This makes for the year 1911 a total of 8,237,723 oz., or $170,273,734, which compares with $155,730,260 in 1910; showing a gain of $14,543,474, or 9.3 per cent.

Iridium—Prices remain without change, $64 per oz. being asked for pure metal.

Platinum—Trade is quiet and prices are unchanged. Dealers ask $46 per oz. for refined platinum and $48.50 per oz. for hard metal.

Silver—Silver shows considerable strength, having advanced from 25 1/16d. during the holiday season to 25 3/16d. in London. At that price China has been a buyer for limited amounts.

SILVER AND STERLING EXCHANGE

Jan.	11	12	13	15	16	17
New York....	55¼	55⅜	55⅜	55⅜	56	55⅜
London.....	25 1/16	25⅛	25⅛	25 3/16	25 1/16	25 1/16
Sterling Ex..	4.8700	4.8710	4.8685	4.8695	4.8685	4.8670

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

NEW YORK

Jan.	Copper: Lake, Cts. per lb.	Copper: Electrolytic, Cts. per lb.	Tin: Cts. per lb.	Lead: New York, Cts. per lb.	Lead: St. Louis, Cts. per lb.	Zinc: New York, Cts. per lb.	Zinc: St. Louis, Cts. per lb.
11	14.30 @14.50	14.20 @14.30	41¼	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
12	14.30 @14.50	14.20 @14.30	41⅜	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
13	14.30 @14.50	14.20 @14.30	41½	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
15	14.30 @14.50	14.10 @14.15	43	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
16	14.30 @14.50	14.10 @14.15	42⅝	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40
17	14.30 @14.50	14.10 @14.15	42¾	4.45	4.32½ @4.37½	6.40 @6.55	6.25 @6.40

The quotations for copper, lead, spelter and tin are for wholesale contracts with consumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The prices of casting copper and of electrolytic cathodes are usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market; for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Jan.	Copper: Spot	Copper: 3 Mos	Copper: Best Sel'td	Tin: Spot	Tin: 3 Mos	Lead, Spanish	Zinc, Ordinaries
11	63 1/16	64 3/16	67⅛	187	183⅛	15 5/16	26¾
12	62⅝	63⅜	67	184	182¼	15 5/16	26¾
13	.....	.....	.....	.....	.....	.....	.....
15	61⅞	62 5/16	66⅛	190	188¼	15 5/16	26¾
16	62 1/16	63 1/16	66⅜	189	186¾	15½	26¾
17	62 1/16	63 5/16	67	188¾	186⅛	15 1/16	26¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—The sharp decline in the London standard market had a very unsettling effect on sentiment. Dealers who are in a position to conduct arbitrage business between London and New York were able to sell electrolytic at very much lower prices than had been quoted previously and retain sufficient margins against standard to enable covering in London at a good profit. European buyers did not purchase in this country because they could secure their supplies to so much better advantage by way of the London market. The sharp ups and downs in London, in which liquidation and speculative and arbitrage transac-

tions played parts, had the natural effect of weakening confidence here, especially on the side of buyers. Consequently, offerings even at sharp concessions fell upon deaf ears and the business done with domestic consumers was of but small proportions. On the other hand, many of the producers, having previously sold largely and being now in a distinctly comfortable position, have had no need to press copper for sale and have maintained their former price at 14½c., delivered, usual terms, for electrolytic. This has become, however, merely a price asked, while business in considerable volume from second hands and some first hands has been done at distinctly lower prices. Business in Lake copper during the week, so far as can be ascertained, was insignificant. A few trifling lots fetched the top price from belated consumers, but in general the market for this kind of metal was merely nominal. The market closes at 14.30@14.50c., nominally, for Lake copper; while electrolytic copper in cakes, ingots and wirebars is at 14.10@14.15c. Casting is quoted nominally at 13⅞@14⅛c. as the average for the week.

The standard market, after breaking to £61 17s. 6d. for spot and £62 11s. 3d. for three months on Jan. 15, a decline of almost £2 10s. from the high point, rallied at the close to £62 16s. 3d. for spot, and £63 11s. 3d. for three months.

Copper sheets are 19@20c. base, for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 15¾c. base, carload lots at mill.

Copper exports from New York for the week were 4577 long tons. Our special correspondent gives the exports from Baltimore at 817 tons.

Visible stocks of copper in Europe on Jan. 15 are reported as follows: England, 41,620; France, 5240; Rotterdam, 5150; Hamburg, 8300; afloat from Chile, 1430; afloat from Australia, 7300; total, 69,040 long tons, or 154,649,600 lb. This is a decrease of 1640 tons as compared with the Dec. 31 report.

Tin—The movements in the London market during the period under review have been very erratic. During the second half of last week prices in London broke, at least so far as spot tin is concerned, to the extent of about £6 per ton. Selling out on part of the Syndicate was given as the reason for the decline. When this liquidation ceased at the beginning of this week, the market quickly recovered its previous decline, not alone for spot, but also for three months tin, which is now selling at a backwardation of only about £2 5s. per ton.

Consumers in this market took advantage of last week's lower prices by placing liberal orders for February-March deliveries, but refused to follow this week's advance and stopped their purchases. The market closes easy at £188 15s. for spot, and £186 10s. for three months in London, and in New York at 42⅜c. for January delivery.

Lead—The market is unchanged at 4.45c. New York, but there has been somewhat more business in Missouri brands and St. Louis prices are firmer at 4.32½@4.37½ cents.

The London market is barely steady, and closes at £15 18s. 9d. for Spanish lead, and £16 1s. 3d. for English.

Spelter—A moderate volume of business in this metal was done during the last week, chiefly for February and March delivery at prices ranging from 6.25 to 6.35c. Occasional carloads for immediate delivery continued to realize a premium. A noteworthy feature for the week was some sales for April and later delivery at a material discount from the current quotations. Quotations at the close are steady at 6.25@6.40c., St. Louis, and 6.40@6.55c., New York.

The London market is unchanged at £26 15s. for good ordinaries, and £27 for specials.

Zinc dust is quoted at 7⅜@7½c. per lb., New York.

Other Metals

Aluminum—Business continues fair, and the market is stronger both here and abroad. Quotations have advanced to 19@19½c. per lb. for No. 1 ingots, New York. Sales of foreign metal have been made at 12c. Ex. duty.

Antimony—Business is again inclined to be quiet. Cookson's is quoted a little lower, at 7½@7¾c. per lb.; Hallett's remains at 7⅜@7⅝c., while 6¾@7c. is named for Hungarian, Chinese and other outside brands.

Quicksilver—The market is rather quiet and prices are unchanged. The New York quotation is $43 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $42.50 per flask for domestic business and $40 for export. London price is £8 per flask, with the same figure quoted by jobbers.

Zinc and Lead Ore Markets

Platteville, Wis., Jan. 6—The base price paid this week for 60 per cent. zinc ore was $44@44.50. The base price paid for 80 per cent. lead ore was $58 per ton.

SHIPMENTS, WEEK ENDED JAN. 6

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Galena	774,100	.....	.....
Mineral Point	724,080	.....	.....
Benton	402,100	.....	163,000
Platteville	306,000	66,000	.....
Hazel Green	304,000	.....	.....
Harker	142,630	.....	.....
Cuba City	88,200	60,560	59,000
Total	2,741,110	126,560	222,000

Shipped during week to separating plants, 1,151,040 lb. zinc ore.

The total shipments from the district, as corrected by adding the last week of the year were: Zinc ore, 151,688,444 lb.; lead ore, 8,981,015 lb.; sulphur ore, 28,939,440 lb. The stock of zinc ore in bins at the close of the year was 11,000 tons, the largest accumulation ever recorded in this district.

The letter for Jan. 13, delayed in the mails until too late for full use, reports zinc ore base $44@44.50; lead ore, no sales. Shipments, 2,302,050 lb. zinc ore, 120,000 lb. lead ore and 132,000 lb. sulphur ore. Deliveries to concentrating plants, 1,094,000 lb. zinc ore.

Joplin, Mo., Jan. 13—The high price paid for zinc sulphide ore was $50, the base, per ton of 60 per cent. zinc, was $44@47. Zinc silicate had no market this week, the small shipment being a previous purchase. The average price, all grades of zinc, was $44.32. The high price of lead ore was $61, with the average for all grades at $60 per ton.

All local stockholders of the Webb City smeltery have disposed of their stock, supposedly to the American Metal Co.; but there are many rumors afloat to the effect that the American Metal Co. has purchased the entire Picher Lead Co. properties, and that the Picher company has secured control of the Webb City smeltery. There is no question that the

SHIPMENTS, WEEK ENDED JAN. 13

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	2,184,160	.....	621,710	$67,830
Joplin	1,449,000	.....	51,870	34,258
Duenweg	890,820	.....	67,400	22,065
Alba-Neck	557,270	.....	.....	12,678
Galena	251,440	.....	120,730	9,260
Miami	63,920	.....	143,600	5,210
Granby	77,280	155,410	1,450	3,880
Carl Junction	150,820	.....	.....	3,620
Jackson	116,900	.....	.....	2,630
Oronogo	72,940	.....	.....	1,121
Totals	5,814,550	155,410	1,006,760	$162,552
2 weeks	14,996,320	428,290	2,130,610	$398,821
Blende val., the week, $130,044; 2 weeks,				$329,168
Calamine, the week, 2,270; 2 weeks,				6,182
Lead value, the week, $30,238; 2 weeks,				$63,471

MONTHLY AVERAGE PRICES

Month	Zinc Ore				Lead Ore	
	Base Price		All Ores		All Ores	
	1910	1911	1910	1911	1910	1911
January	$47.31	$41.85	$45.16	$40.55	$56.99	$55.68
February	40.69	40.21	39.47	39.16	53.64	54.46
March	43.60	39.85	39.71	38.45	51.26	54.57
April	41.00	38.88	39.33	37.47	49.72	56.37
May	40.19	38.25	37.51	36.79	48.16	55.21
June	40.20	40.50	37.83	38.18	48.80	56.49
July	39.63	40.75	36.80	38.36	48.59	58.81
August	40.13	42.50	37.32	41.28	49.75	60.74
September	43.45	42.63	39.96	41.29	54.73	59.33
October	43.31	42.38	40.50	40.89	53.18	54.72
November	47.20	45.40	43.20	43.25	54.80	57.19
December	42.50	44.13	40.70	40.76	55.70	62.03
Year	$42.43	$41.45	$39.79	$39.90	$52.12	$56.76

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

American company is in control, nor that frequent conferences are being held between representatives of the interested parties, but what it portends cannot be conjectured.

New Caledonia Ores

Exports of ores from New Caledonia 10 months ended Oct. 31 are reported by the *Bulletin du Commerce* of Noumea at 89,163 metric tons nickel ore and 32,760 tons chrome ore. Exports of metals were 1264 tons nickel matte and 675 tons copper matte.

Chemicals

New York, Jan. 17—The general market is in a little better condition and more activity is developing.

Copper Sulphate—Demand is quite active. Spot requirements are mainly covered, and dealers look for some advance. So far, quotations are unchanged at $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

Arsenic—Trade has been active, but supplies seem about equal to demand. Prices are firm at $2.37½@2.50 per 100 lb. for white arsenic.

Nitrate of Soda—Business is rather quiet and prices unchanged at 2.20c. per lb. for both spot and futures.

Messrs. W. Montgomery & Co. write from London, Jan. 10, as follows: "In reviewing the trade of the past six months we have to note a falling off in deliveries in Europe of 8000 tons, and to this extent reducing the advantage of 53,000 tons gained during the first six months of the year. Thus the European consumption for the 12 months ended amounts to 1,696,000 tons, against 1,651,000 in 1910, an increase of 45,000 tons, or 2¾ per cent. The United States, on the other hand, for the last six months shows an increase to the extent of 15,000 tons, the figures being 229,000 tons, against 214,000, while those for the 12 months, at 550,000 tons, compare with 510,000, an increase of 49,000, or 10 per cent. Other parts for the 12 months show an increase of 16 per cent., the figures being 103,000 tons, against 89,000 tons for 1910. Thus the world's consumption for 1911 amounts to 2,349,000 tons, against 2,241,000 in 1910, an increase of 4.82 per cent. . . .

"Production for the last 12 months (estimating that for December at 4,900,000 quintals) amounted to 54,880,000 quintals, which compares with 53,596,000, an increase of 1,284,000, or 58,000 tons, while shipments to all parts for the 12 months were 2,406,000 tons, against 2,300,000, or an increase of 106,000 tons. From these figures it is noticeable that the increase in production has been slowing down. . . . Stock in Chile is today 10,400,000 quintals, against 9,909,000 a year ago. Stock in Europe today amounts to 479,000 tons, against 314,000 12 months ago."

Petroleum

Exports of mineral oils from the United States for the year ended Dec. 31 are reported at 1,395,095,440 gal. in 1910, and 1,622,644,920 gal, in 1911; increase 227,549,480 gal. or 16.3 per cent.

The *Oil City Derrick* reports new wells completed in December as follows: New York, Pennsylvania and West Virginia, 380; Lima-Indiana, 39; Kentucky, 9; Illinois, 108; total, 536, having an aggregate production of 6535 bbl. daily.

Mining Stocks

New York, Jan. 17—On Thursday, Jan. 11, the general market was slow and inclined to be reactionary. On the Curb dealings were small, and copper stocks generally lost a little. Cobalts also declined slightly, but Porcupines were firm.

On Jan. 12, the anthracite-coal road stocks were the chief feature on the Exchange, and other stocks were slow. On the Curb mining stocks were rather neglected and weak. Dealings were started in Lehigh Valley Coal Sales Co. "when issued," sales have been made between 185 and 210, for about 1000 shares.

On Jan. 13 the market was slow and narrow, both on the Exchange and the Curb.

On Jan. 15 strength developed on the Exchange, but on moderate trading; price movements were rather narrow, but the tendency was upward. On the Curb trading in mining stocks was more active, and there were fractional advances, especially in the copper stocks.

On Jan. 16 there was some activity again and good advances in the anthracite stocks on the Exchange; industrials were generally slow and with few changes. On the Curb trading in mining stocks was fair and some of the coppers advanced, but only by small fractions. On Jan. 17 the course of the markets was much the same, and changes were small.

Boston, Jan. 16—It has been a period of profit taking in mining shares during the week. The work has been largely one of professional operations. Today, however, saw a better list of prices but practically only in the Lake Superior issues.

The recent strike in the Mayflower is now followed by news that the Hancock has cut a good lode at a depth of 3218 ft. This brought buying which caused Hancock to advance $5 to $34.75. Centennial also spurted $2.25 to $20.25. Both Mayflower and Old Colony prices have yielded after the first knowledge of rich drill cores in the first named.

Elm River, which has been reorganized into the Contact Copper Co., took a new lease of life marketwise, upon the decision to extend the time for depositing the stock until Jan. 31, with the stipulation that interest should be charged from July 1, 1910. Trinity moved up with First National, the latter being a Curb issue. President Lawson of these companies has circularized stockholders

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	October	Nov.	Dec.
Alaska shipments.	2,704,802	1,274,655	4,995,008
Anaconda	21,400,000	20,850,000	.....
Arizona, Ltd.	2,720,000	2,960,000	3,100,000
Balakiala	.....	.....	.....
Copper Queen	7,786,218	6,946,775	.....
Calumet & Ariz.	4,784,000	4,390,000	4,486.000
Detroit	2,086,624	1,941,498	.....
East Butte	920,000	983,405	.....
Mammoth	1,865,846	1,793,181	.....
Miami	.....	.....	2,500,000
Nevada Con.	5,547,931	5,207,983	.....
Old Dominion	2,050,000	2,082,000	2,610,000
Roy	2,069,287	2,517,000	2,660,000
Shannon	1,124,000	1,256,000	.....
South Utah	326,578	361,681	267,514
United Verde*	2,750,000	2,500,000	.....
Utah Copper Co.	8,660,729	9,117,961	.....
Lake Superior*	18,440,000	18,600,000	17,500,000
Non-rep. mines*	13,564,713	11,483,000	.....
Total production.	98,800,728	94,265,139	.....
Imports, bars, etc.	22,960,027	17,224,725	.....
Total blister	121,760,755	111,489,864	.....
Imp. in ore & matte	4,137,431	4,767,217	.....
Total	125,898,186	116,257,081	.....
Brit. Col. Cos.:			
British Col. Copper	778,586	.....	.....
Granby	.....	.....	.....
Mexican Cos.:			
Boleo	1,245,440	.....	2,645,640
Cananea	5,804,000	.....	3,706,000
Moctezuma	1,719,643	1,682,768	.....
Other Foreign:			
Cape Cop., S. Africa	.....	857,920	.....
Spassky, Russia	672,000	685,440	.....
Famatina, Argen.	.....	174,720	.....
Exports from:			
Chile	4,816,000	4,704,000	5,824,000
Australia	7,056,000	7,168,000	11,200,000

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.
*Estimated.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
Year 1910	1,452,122,120	749,426.542	722,431,494
I, 1911	115,696,591	42,078,557	53,208,739
II	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233

	VISIBLE STOCKS		
	United States	Europe	Total
I, 1911	122,030,195	236,629,120	358,649,378
II	142,439,490	236,992,000	379,431,134
III	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. From Jan. 1, 1911, stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

to the effect that a new copper extraction process has been devised to cope with the smoke-nuisance difficulties of the California smelters.

Prices on the Curb show a general hardening tendency.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22	.....	$1.00
Alta, Nev	Jan. 26	Feb. 16	0.05
Andes, Nev	Feb. 7	Feb. 28	0.05
Belcher, Nev	Jan. 3	Jan. 24	0.10
Black Jack, Utah,	Feb. 6	.....	0.01
Boston Ely, Nev	Jan. 18	.....	0.50
Bruns. C. V. M., Nev	Jan. 12	Feb. 2	0.02
Bullion, Nev	Jan. 12	Jan. 29	0.05
Chollar, Nev	Jan. 3	Jan. 26	0.10
Confidence, Nev	Jan. 16	Feb. 6	0.20
Con. Imperial, Nev	Jan. 16	Feb. 7	0.01
Con. Virginia, Nev	Dec. 16	Jan. 6	0.25
Federal Ely, Nev	Jan. 5	Jan. 27	0.01
Fetish, Ida	Jan. 5	Jan. 23	0.001½
Gold Springs, Nev	Jan. 17	Feb. 3	0.04
Gould & Curry, Nev	Jan. 24	Feb. 13	0.05
Hancock Con., Mich	Jan. 10	.....	1.00
Kentuck Con., Nev	Jan. 9	Jan. 26	0.05
Ojibway, Mich	Jan. 10	.....	1.00
Raven, Mont	Feb. 1	.....	0.10
Seven Troughs Mon., Nev	Jan. 10	Jan. 31	0.002½
Sierra Nevada, Nev	Jan. 23	Feb. 13	0.10
Southwestern Miami, Ariz.	Jan. 15	.....	1.00
Spider, Utah	Jan. 15	Feb. 15	0.002½
Swansea Con., Utah	Jan. 17	Feb. 8	0.015
Tintic Standard, Utah	Jan. 8	Feb. 5	0.00
Utah, Nev	Jan. 19	Feb. 9	0.05
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1909.	1910.	1911.	1909.	1910.	1911.
January	51.750	52.375	53.795	23.843	24.154	24.865
February	51.472	51.534	52.222	23.706	23.794	24.081
March	50.468	51.454	52.745	23.227	23.690	24.324
April	51.428	53.221	53.325	23.708	24.483	24.595
May	52.905	53.870	53.308	24.343	24.797	24.583
June	52.538	53.462	53.043	24.166	24.651	24.486
July	51.043	54.150	52.630	23.519	25.034	24.286
August	51.125	52.912	52.171	23.588	24.428	24.082
September	51.440	53.295	52.440	23.743	24.567	24.209
October	50.923	55.490	53.340	23.502	25.596	24.594
November	50.703	55.635	55.719	23.351	25.680	25.649
December	52.226	54.428	54.905	24.030	25.160	25.349
Total	51.502	53.486	53.304	23.706	24.670	24.592

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1910.	1911.	1910.	1911.	1910.	1911.
January	13.620	12.295	13.870	12.680	60.923	55.600
February	13.332	12.256	13.719	12.611	59.388	54.974
March	13.255	12.139	13.586	12.447	59.214	54.70½
April	12.733	12.019	13.091	12.275	57.238	54.034
May	12.550	11.989	12.885	12.214	56.313	54.313
June	12.404	12.385	12.798	12.611	55.310	56.365
July	12.215	12.463	12.570	12.720	54.194	56.673
August	12.490	12.405	12.715	12.634	55.733	56.266
September	12.379	12.201	12.668	12.508	55.207	55.253
October	12.553	12.189	12.788	12.370	56.722	55.170
November	12.742	12.616	12.914	12.769	57.634	57.253
December	12.581	13.552	12.863	13.768	56.769	62.068
Year	12.738	12.376	13.039	12.634	57.054	55.973

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1910.	1911.	Month	1910.	1911.
January	32.700	41.255	July	32.695	42.400
February	32.920	41.614	August	33.972	43.319
March	32.463	40.157	September	34.982	39.755
April	32.976	42.185	October	36.190	41.185
May	33.125	43.115	November	36.547	43.125
June	32.769	44.606	December	38.199	44.655
			Av. Year	34.123	42.281

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	4.700	4.483	4.582	4.334	13.650	13.009
February	4.613	4.440	4.445	4.266	13.328	13.043
March	4.459	4.394	4.307	4.238	13.063	13.122
April	4.376	4.412	4.225	4.262	12.641	12.889
May	4.315	4.373	4.164	4.223	12.550	12.984
June	4.343	4.435	4.207	4.292	12.688	13.260
July	4.404	4.499	4.291	4.397	12.531	13.530
August	4.400	4.500	4.290	4.406	12.513	14.260
September	4.400	4.485	4.289	4.356	12.582	14.744
October	4.400	4.265	4.271	4.139	13.091	15.332
November	4.442	4.298	4.314	4.181	13.217	15.821
December	4.500	4.450	4.363	4.332	13.197	15.648
Year	4.446	4.420	4.312	4.286	12.920	13.970

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1910.	1911.	1910.	1911.	1910.	1911.
January	6.101	5.452	5.951	5.302	23.350	23.887
February	5.569	5.518	5.419	5.368	23.188	23.276
March	5.637	5.563	5.487	5.413	23.031	23.016
April	5.439	5.399	5.289	5.249	22.469	23.743
May	5.191	5.348	5.041	5.198	22.100	24.375
June	5.128	5.520	4.978	5.370	22.094	24.612
July	5.152	5.695	5.002	5.545	22.406	25.006
August	5.279	5.953	5.129	5.803	22.800	26.801
September	5.514	5.869	5.364	5.719	23.165	27.750
October	5.628	6.102	5.478	5.951	23.900	27.256
November	5.976	6.380	5.826	6.223	24.083	26.795
December	5.624	6.301	5.474	6.151	24.019	26.849
Year	5.520	5.758	5.370	5.608	23.050	25.281

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1910	1911	1910	1911	1910	1911
January	$19.90	$15.90	$17.98	$14.40	$17.94	$14.75
February	18.96	15.90	17.21	14.50	17.38	14.81
March	18.53	15.90	16.93	14.65	17.00	14.96
April	18.28	15.90	16.84	14.65	16.75	15.00
May	17.10	15.90	15.94	14.30	16.18	14.72
June	16.52	15.90	15.60	14.06	15.53	14.56
July	16.40	15.90	15.40	14.03	15.40	14.53
August	16.09	15.90	14.89	14.00	15.16	14.47
September	15.92	15.90	14.73	13.57	14.93	14.40
October	15.90	15.43	14.05	13.44	14.88	14.34
November	15.84	14.92	14.26	13.30	14.78	14.25
December	15.90	15.15	14.15	13.10	14.65	13.90
Year	$17.10	$15.72	$15.65	$13.94	$15.83	$14.49

STOCK QUOTATIONS

COLO. SPRINGS Jan. 16

Name of Comp.	Bid.
Acacia	.05
Cripple Cr'k Con.	.02½
C. K. & N.	.17
Doctor Jack Pot	.06½
Elkton Con	.69
El Paso	.75
Findlay	.05⅞
Gold Dollar	.17
Gold Sovereign	.02⅞
Isabella	.17½
Jack Pot	.06½
Jennie Sample	.06⅞
Lexington	.01½
Moon Anchor	.01⅜
Old Gold	.03
Mary McKinney	.53
Pharmacist	.02½
Portland	.91
Vindicator	.69½
Work	.03

SALT LAKE Jan. 16

Name of Comp.	Bid.
Beck Tunnel	.13
Black Jack	.09½
Carisa	‡.17
Cedar Talisman	.03
Colorado Mining	.30½
Columbus Con	‡.23
Daly-Judge	‡5.20
Grand Central	.70
Iron Blossom	1.02½
Little Bell	.38
Lower Mammoth	.02½
Mason Valley	11.00
May Day	.16
Nevada Hills	‡2.50
New York	‡.07
Prince Con	.78
Silver King Coal'n	1.65
Sioux Con	.11
Uncle Sam	.23
Yankee	‡.24

TORONTO Jan. 16

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	‡6.50	Pearl Lake	.21
Hudson Bay	‡80.00	Porcu. Gold	.47½
Temiskaming	‡.35	Porcu. Tisdale	.03
Wettlaufer-Lor	.76	Preston E. D.	.06½
Apex	‡.08	West Dome	.40
Central	3.50	Standard	.17
Dobie	.70	Foley O'Brien	.30
Dome Exten	.38	Rea	1.50
Hollinger	12.45	Crown Chartered	.12
Imperial	.05	Swastika	.24½

SAN FRANCISCO Jan. 16

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.02	Belmont	8.00
Belcher	.60	Jim Butler	.33
Best & Belcher	.15	MacNamara	.26
Caledonia	1.45	Midway	.22
Challenge Con	.14	Mont.-Tonopah	1.00
Chollar	.19	North Star	.30
Confidence	.55	West End Con	.72
Con. Virginia	.88	Atlanta	.18
Crown Point	.60	Booth	.06
Gould & Curry	.04	C.O.D. Con	.12
Hale & Norcross	.17	Comb. Frac	.13
Mexican	4.12½	Jumbo Extension	.22
Occidental	.50	Pitts.-Silver Peak	1.30
Ophir	1.47½	Silver Pick	.06
Overman	1.10	St. Ives	.30
Potosi	.10	Tramps Con	.01
Savage	.16	Argonaut	2.50
Sierra Nevada	.27	Bunker Hill	‡3.00
Union Con	1.22½	Cent. Eureka	.40
Yellow Jacket	.45	So. Eureka	‡6.00

N. Y. EXCH. Jan. 16

Name of Comp.	Clg.
Amalgamated	65⅛
Am. Agri. Chem.	60¾
Am.Sm.&Ref.,com	71⅛
Am. Sm.& Ref., pf.	103
Am. Sm. Sec., pf. B	87
Anaconda	36
Batopilas Min	1½
BethlehemSteelpf	61⅜
Chino	25½
Federal M.& S., pf.	37
Goldfield Con	4¼
Great Nor., ore ctf.	40
Homestake	87
Miami Copper	24
Nat'nalLead,com.	53
National Lead, pf.	105⅞
Nev. Consol	19½
Pittsburg Coal, pf.	81½
Ray Con	17⅝
RepublicI&S,com	25½
Republic I & S, pf.	85
SlossSheffi'd,com.	40
Sloss Sheffield, pf.	‡108¼
Tennessee Copper	‡38
Utah Copper	56⅜
U. S. Steel, com	66⅜
U. S. Steel, pf.	110⅞
Va. Car. Chem	53½

N. Y. CURB Jan. 16

Name of Comp.	Clg.
Barnes King	‡.35
Beaver Con	.42
Braden Copper	5⅝
B. C. Copper	4
Buffalo Mines	‡1.50
Butte & Vipond	.53
Butte Coalition	22¾
Cobalt Central	‡.01
Con. Ariz. Sm.	¾
Davis-Daly	⅞
Diam'field-Daisy	13
Ely Con	2/16
Florence	.61
Giroux	4 9/16
Gold Hill Con	‡1/16
Greene Cananea	8½
Greenwater	.06
Guggen. Exp	180
Inspiration	10¼
Internat. S. & R.	‡124
Kerr Lake	‡2¾
La Rose	‡3¾
McKinley-Dar-Sa.	‡1⅝
Min. Co. of A. new	‡4
Nev. Utah M. & S.	‡1/16
Nipissing Mines	6¼
Ohio Copper	1
Pacific Sm. & M.	7/16
Porcupine T'nsite	.47
Precious Metals	‡1⅜
Ray Central	1⅞
Red Warrior	‡1½
South Utah M.& S.	1/16
Standard Oil (Old)	625
Stand'd Oil of N.J.	370
Stand'd Oil Subs.	325
Stewart	.90
Tonopah	6⅞
Tonopah Ex	1⅞
Tri-Bullion	‡⅛
Tularosa	‡⅛
Yukon Gold	3⅜

LONDON Jan. 17

Name of Com.	Clg.
Camp Bird	£1 11s 6d
Dolores	1 10 0
El Oro	0 17 3
Esperanza	2 8 9
Mexico Mines	7 15 0
Oroville	0 4 9
Stratton'sInd.	0 3 1½
Tomboy	1 3 9

BOSTON EXCH. Jan. 16

Name of Comp.	Clg.
Adventure	6
Algomah	4¾
Allouez	42
Am. Zinc	35¾
Ariz. Com., ctfs.	3⅛
Bonanza	.45
Boston & Corbin	9
Butte & Balak	4¼
Calumet & Ariz	61⅜
Calumet & Hecla	442
Centennial	19¼
Con. Mercur	.05
Copper Range	54
Daly West	5½
East Butte	12⅜
Franklin	12
Granby	38
Hancock	34¾
Hedley Gold	17
Helvetia	1¼
Indiana	12½
Island Cr'k, com.	41
Isle Royale	21¾
Keweenaw	1½
Lake	36½
La Salle	5
Live Oak	40½
Mass	8¼
Michigan	3
Mohawk	56⅞
New Arcadian	4
New Idria Quick.	7⅝
North Butte	27
North Lake	6
Ojibway	6¼
Old Dominion	47
Osceola	109
Parrot	13¼
Quincy	75½
Shannon	10
Shattuck-Ariz.	18
Superior	27½
Superior & Bost.	4 1/16
Tamarack	30
Trinity	6¾
Tuolumne	3⅝
U. S. Smelting	34⅝
U. S. Smelt'g, pf.	48
Utah Apex	3
Utah Con	16
Victoria	4½
Winona	5¾
Wolverine	99
Wyandot	2½

BOSTON CURB Jan. 16

Name of Comp.	Last
Ahmeek	235
Bingham Mines	2⅛
Boston Ely	.86
Boswyocolo	.09
Cactus	.15
Calaveras	1 9/16
Chief Cons	.68
Corbin	3
Cortez	1½
Crown Reserve	21½
First Nat. Cop.	2⅜
Majestic	.43
Mazatan	.90
Moneta Porc.	.16
Nat'l Mine & Ex.	‡.12
Nevada-Douglas	2⅞
New Baltic	5½
Oneco	2 1/16
Raven Copper	.27
Rhode Island Coal	.46
San Antonio	‡3½
South Lake	5⅞
Trethewey	.55
Union Mines	‡½
United Verde Ext.	.70
Vulture	‡5⅞

‡Last quotation